

# Fractured Rock Case Study – Pine Valley Trailer Park

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Tony V. Sawyer, CHg

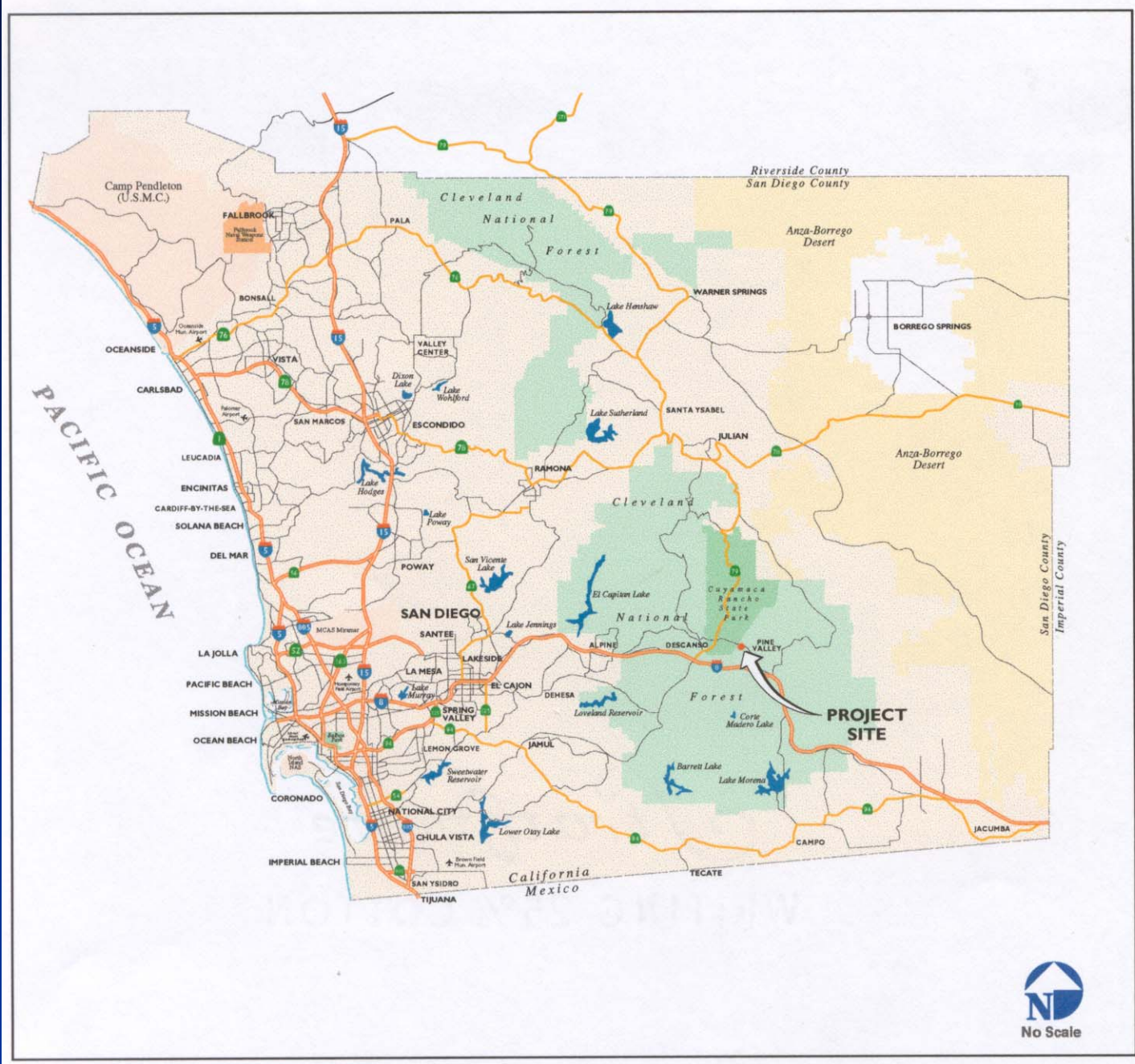
County of San Diego

Department of Environmental Health

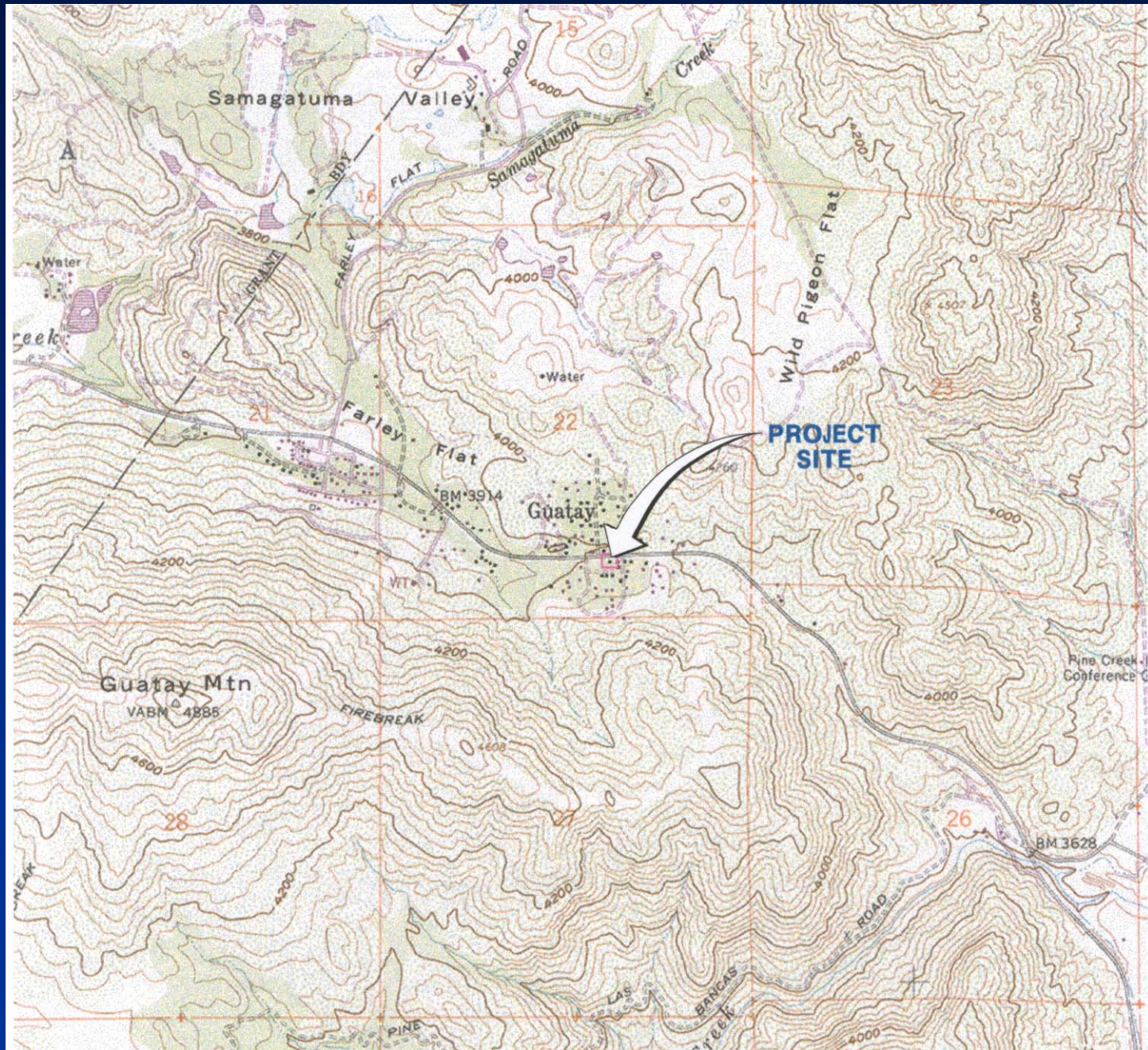


# Geomorphic Setting

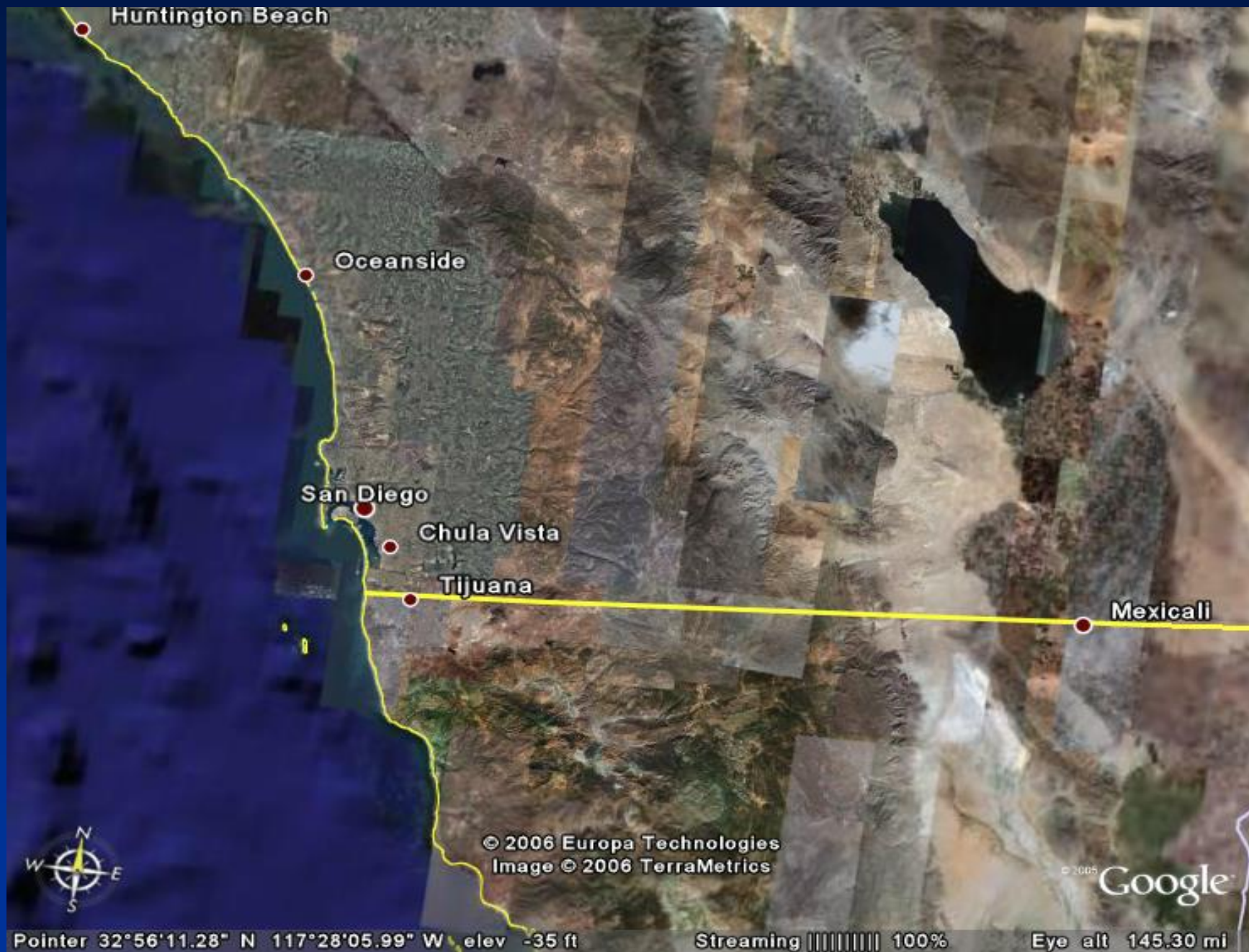


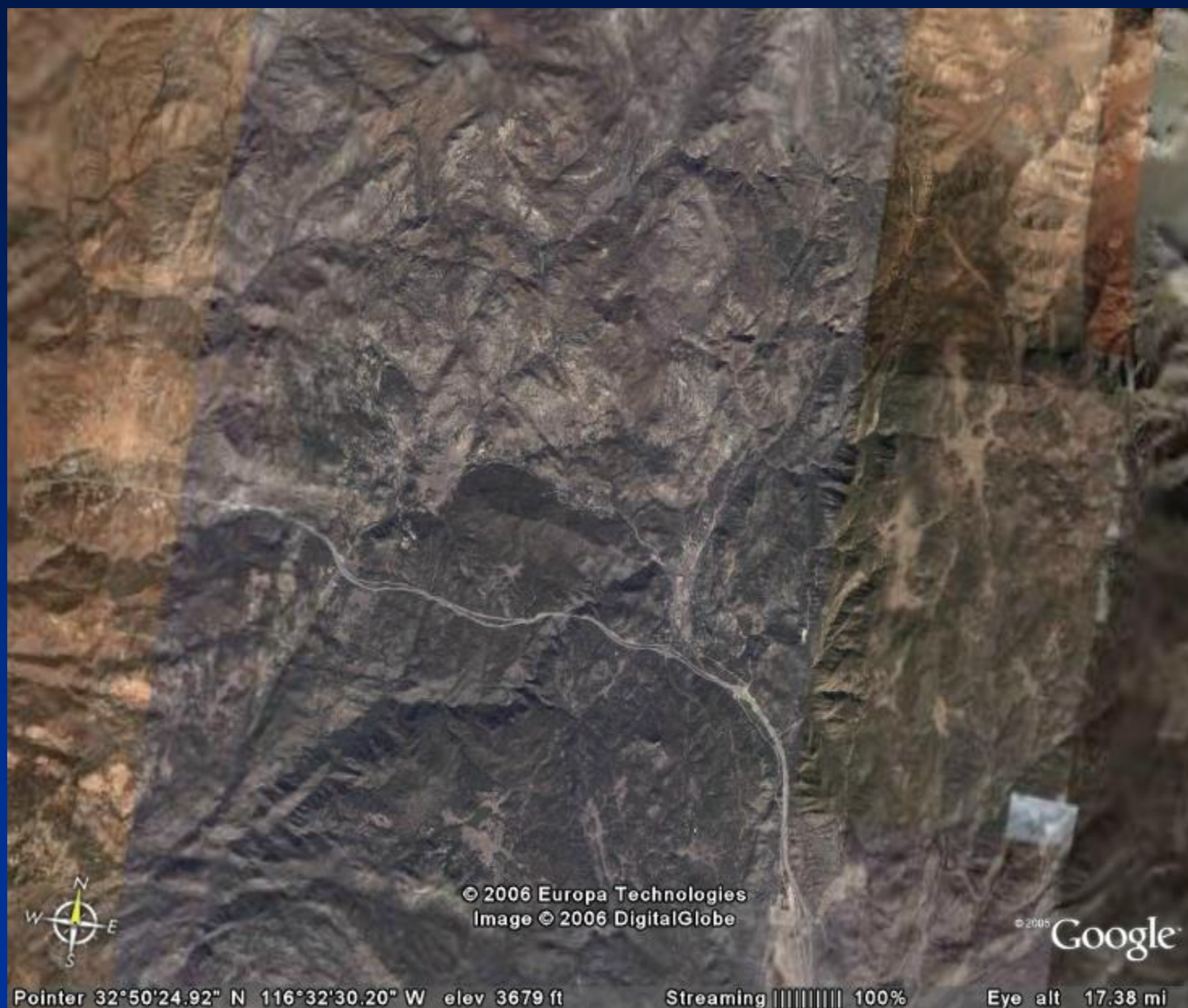












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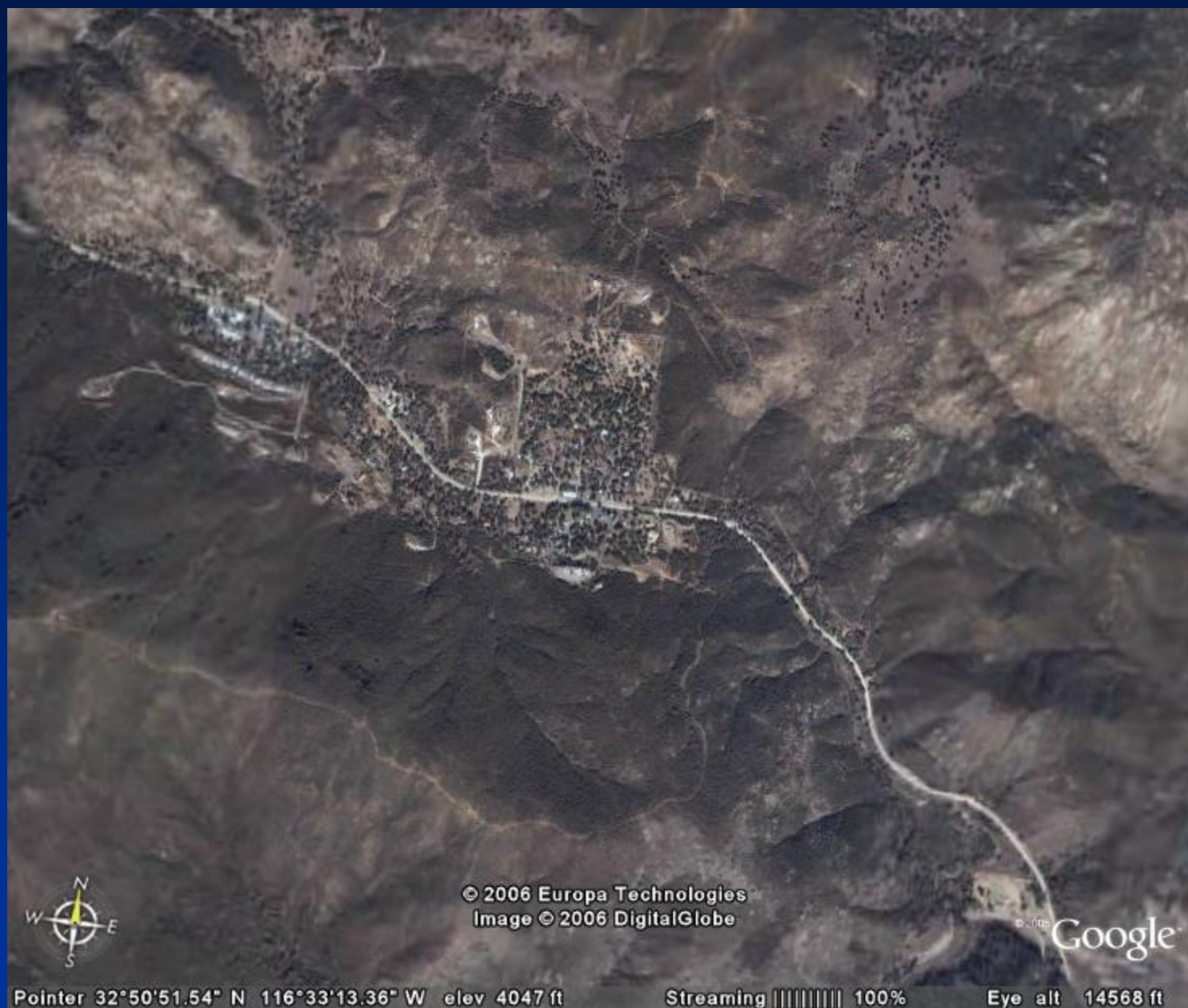
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Pointer 32°50'24.92" N 116°32'30.20" W elev 3679 ft

Streaming ||||| 100%

Eye alt 17.38 mi





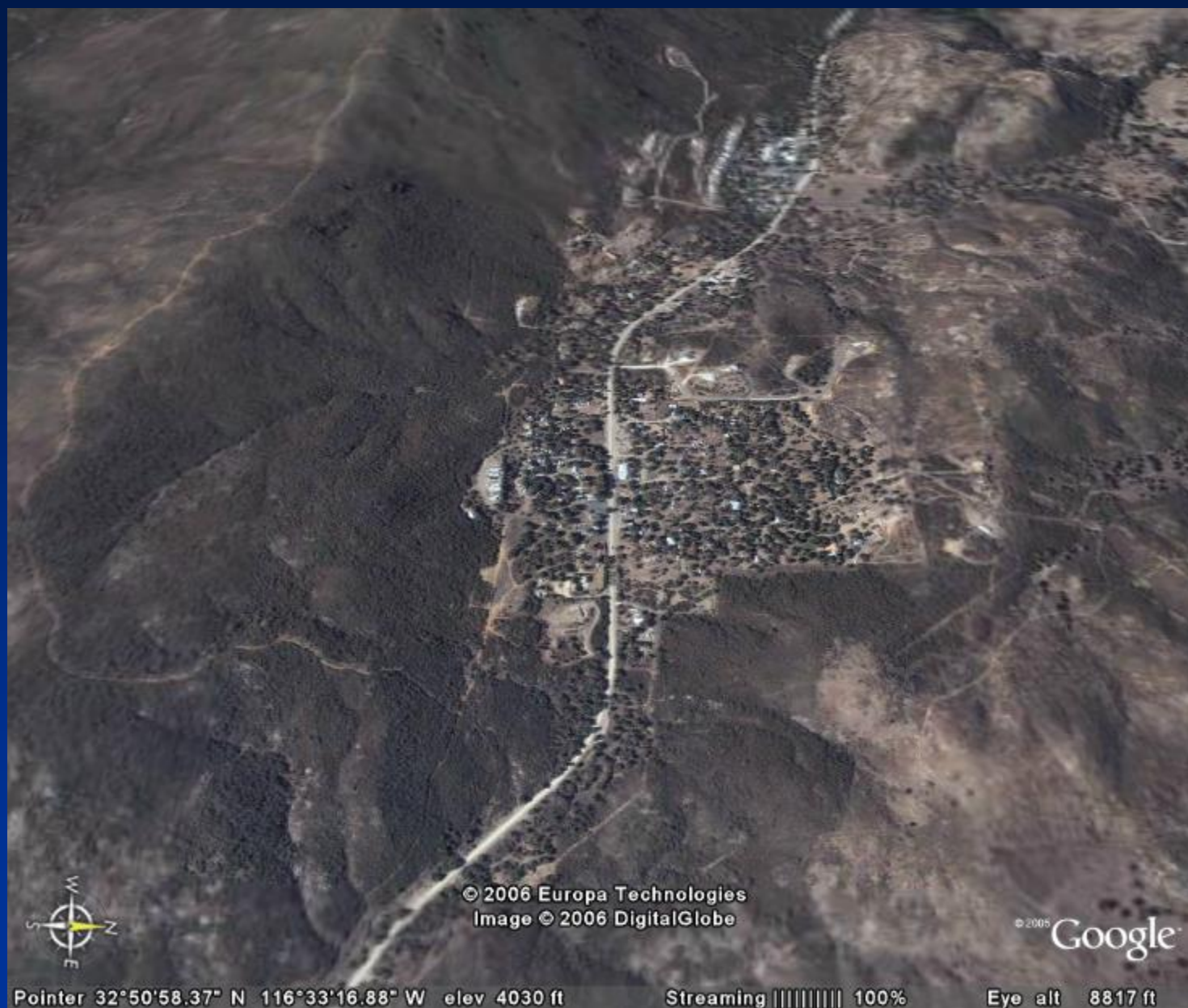
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Pointer 32°50'51.54" N 116°33'13.36" W elev 4047 ft

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Eye alt 14568 ft



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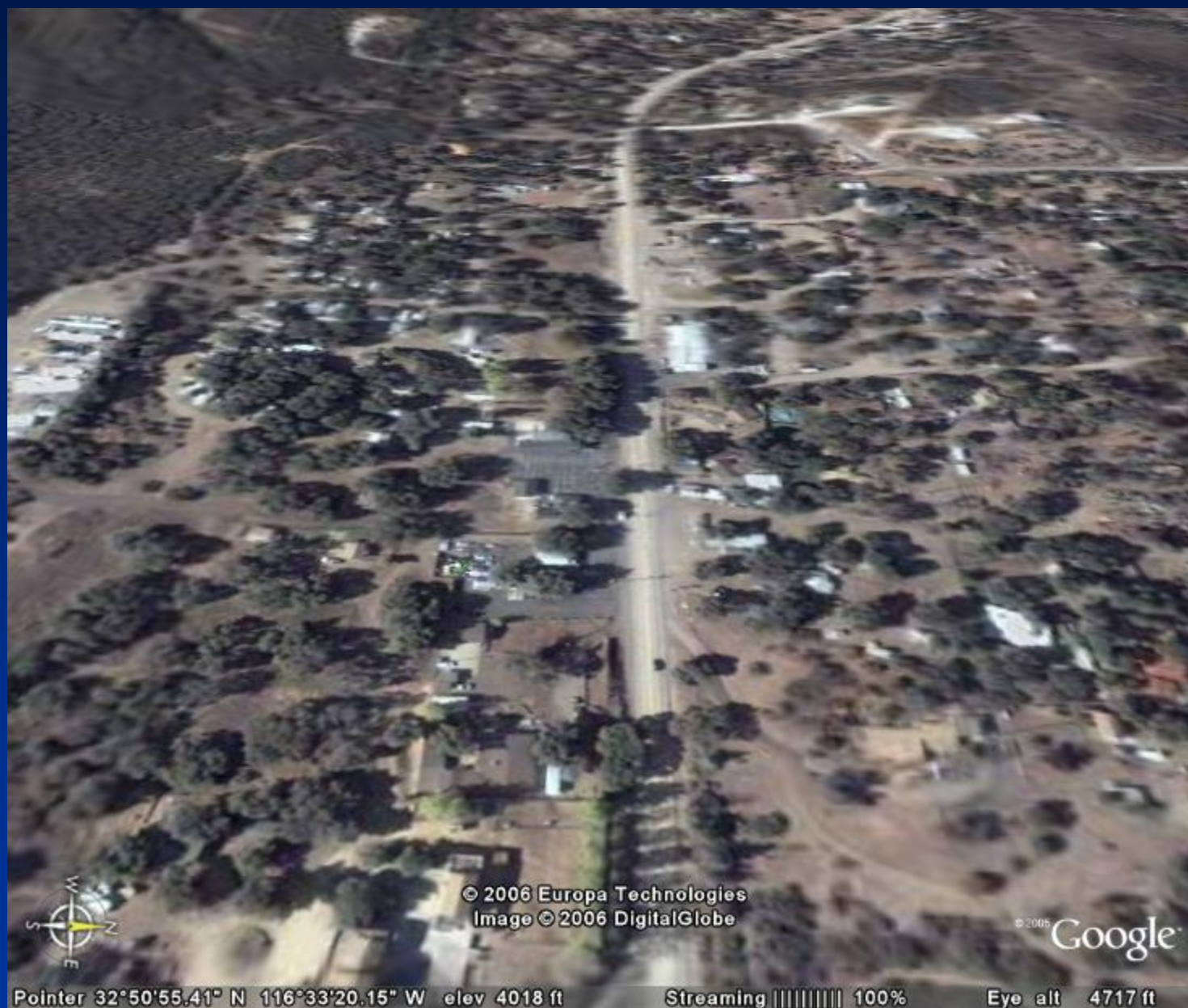
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Pointer 32°50'58.37" N 116°33'16.88" W elev 4030 ft

Streaming ||||| 100%

Eye alt 8817 ft











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Pointer 32°50'55.41" N 116°33'20.15" W elev 4018 ft

Streaming ||||| 100%

Eye alt 5125 ft



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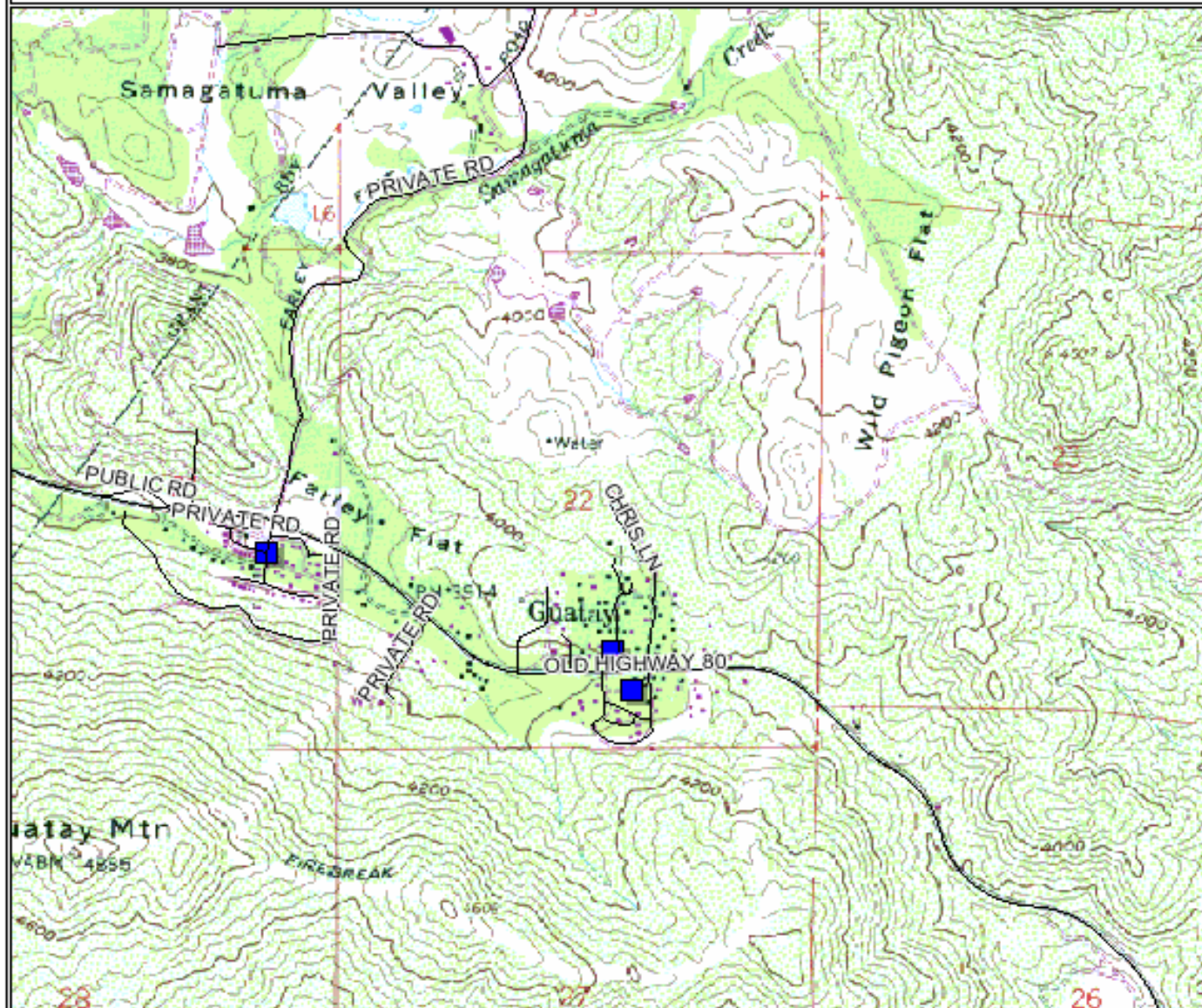
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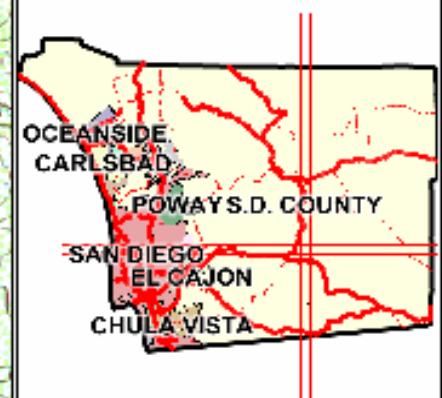


# Guatay Topo SWS



## Legend

- Streets
- Highways
- Freeways
- Small Water Systems
- County Boundary
- USGS 7.5 Min Topo Quad Boundary



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Scale 1:24,913

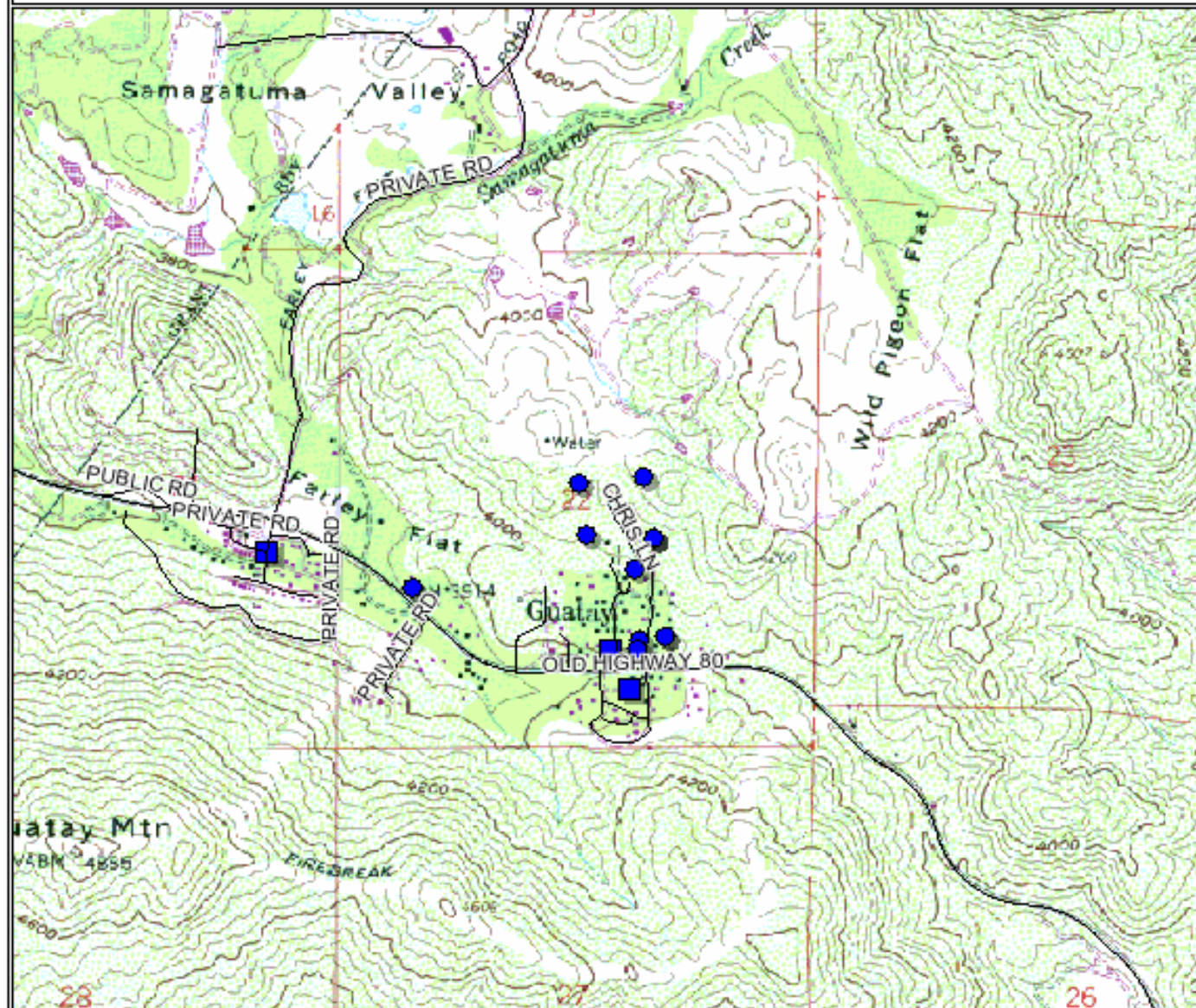
San Diego County Department of Environmental Health

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# Topo SWS and Private Wells



## Legend

- Streets
- Highways
- Freeways
- LWQD Wells
- Small Water Systems
- County Boundary
- USGS 7.5 Min Topo Quad Boundary



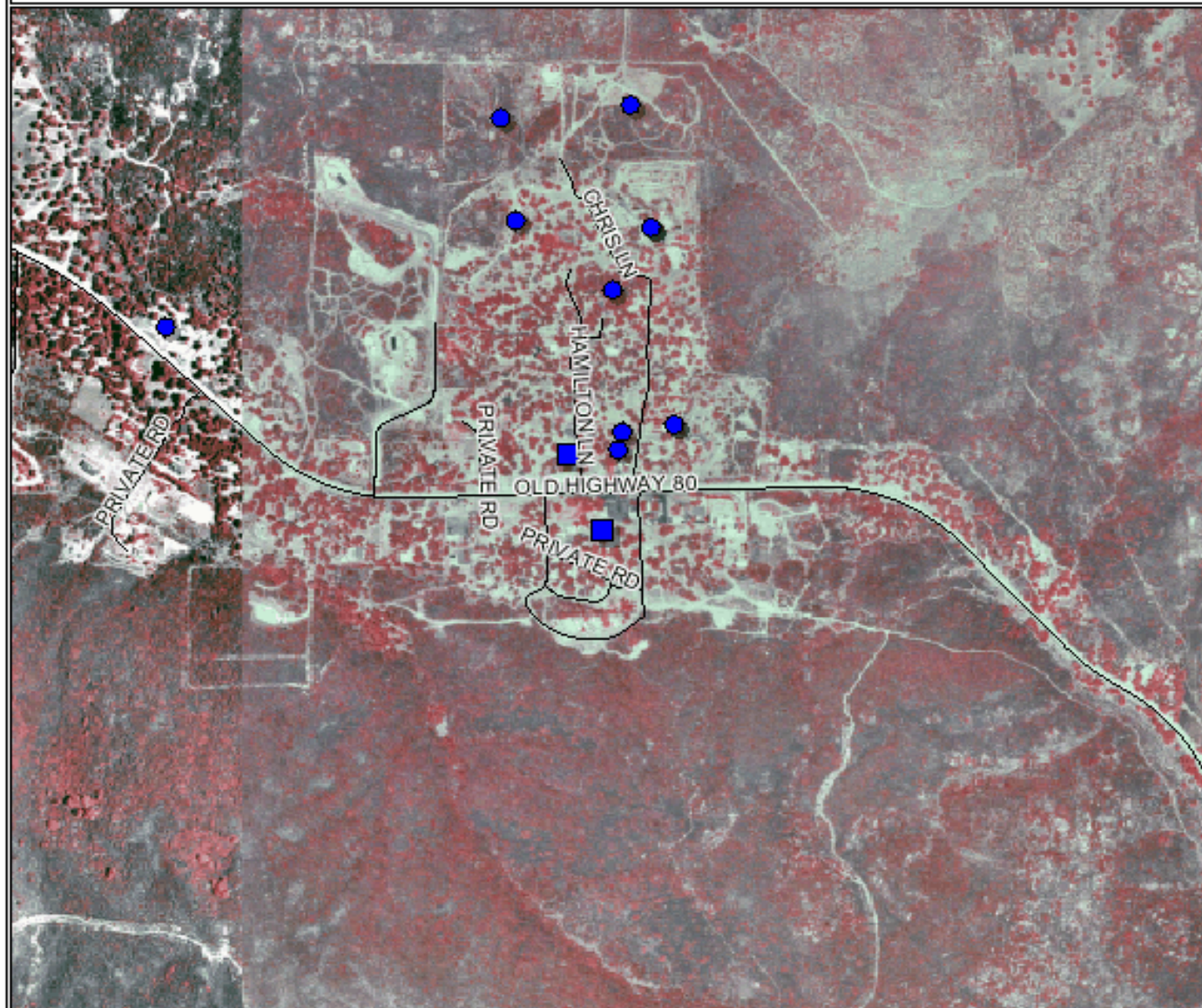
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# Guatay Ortho



## Legend

- Streets
- Highways
- Freeways
- LWQD Wells
- Small Water Systems
- County Boundary
- 2002 Aerial Photo - East
- 2002 Aerial Photo - West



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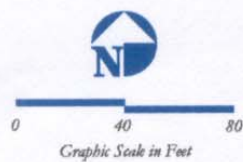
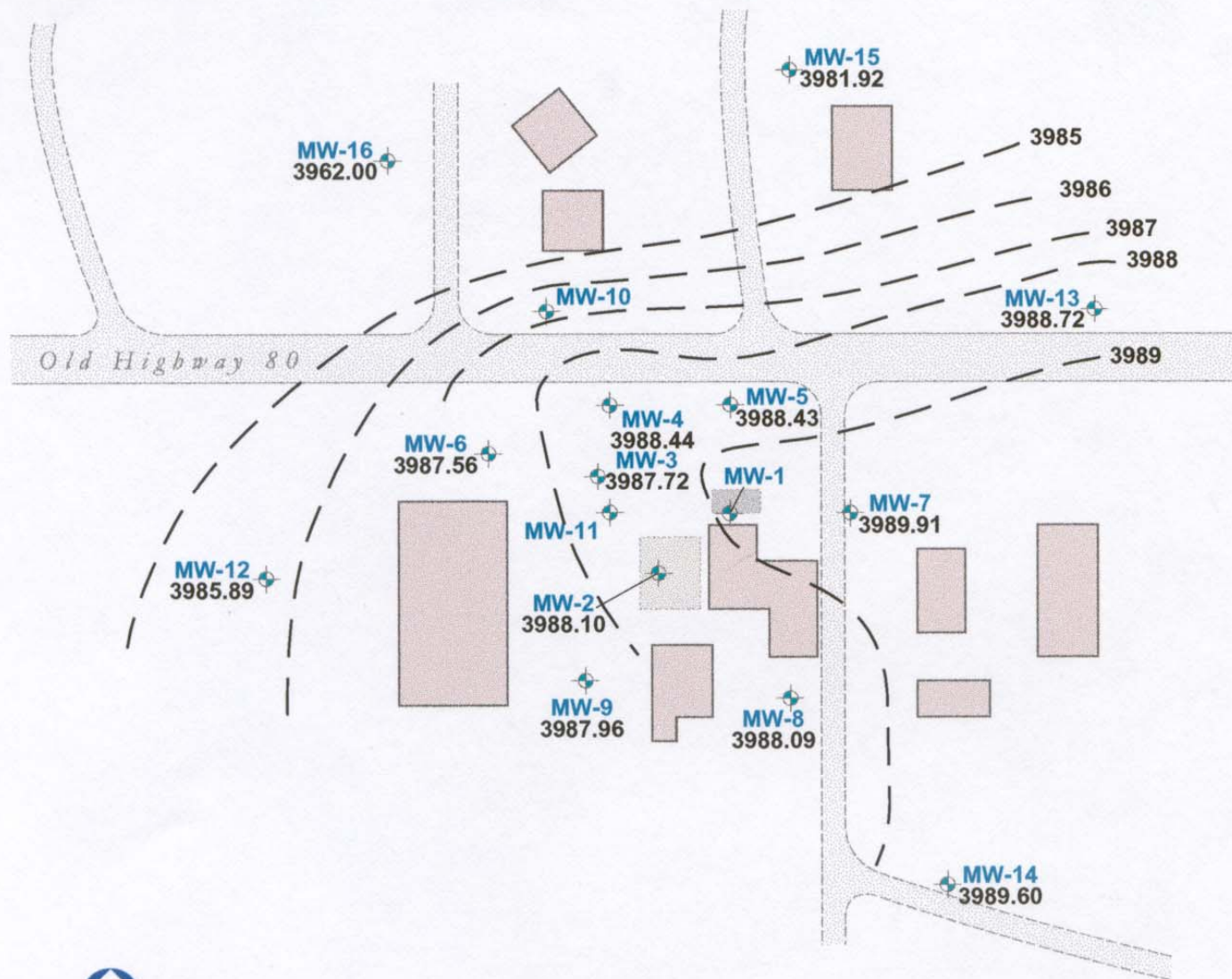


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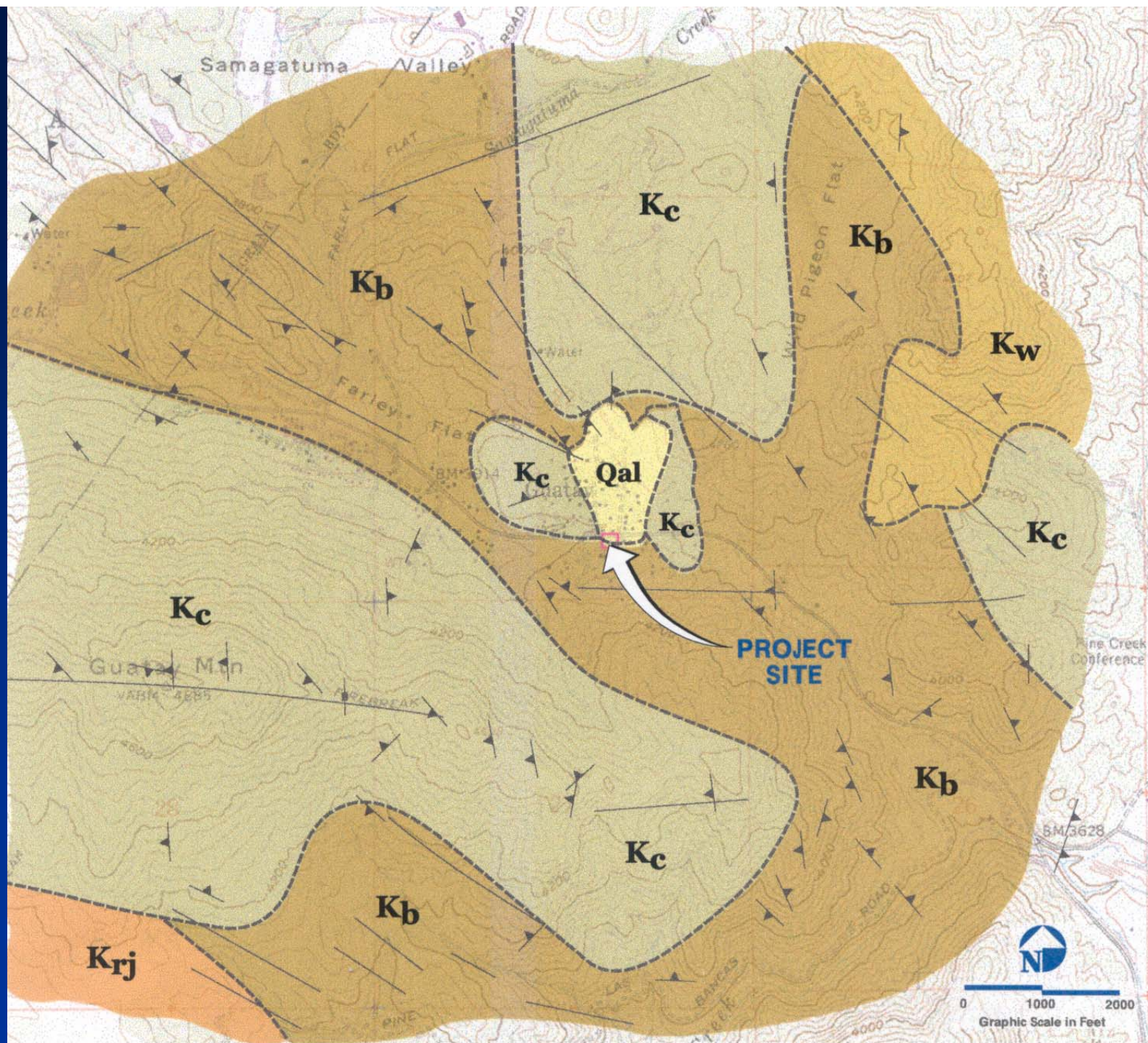






































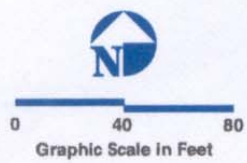
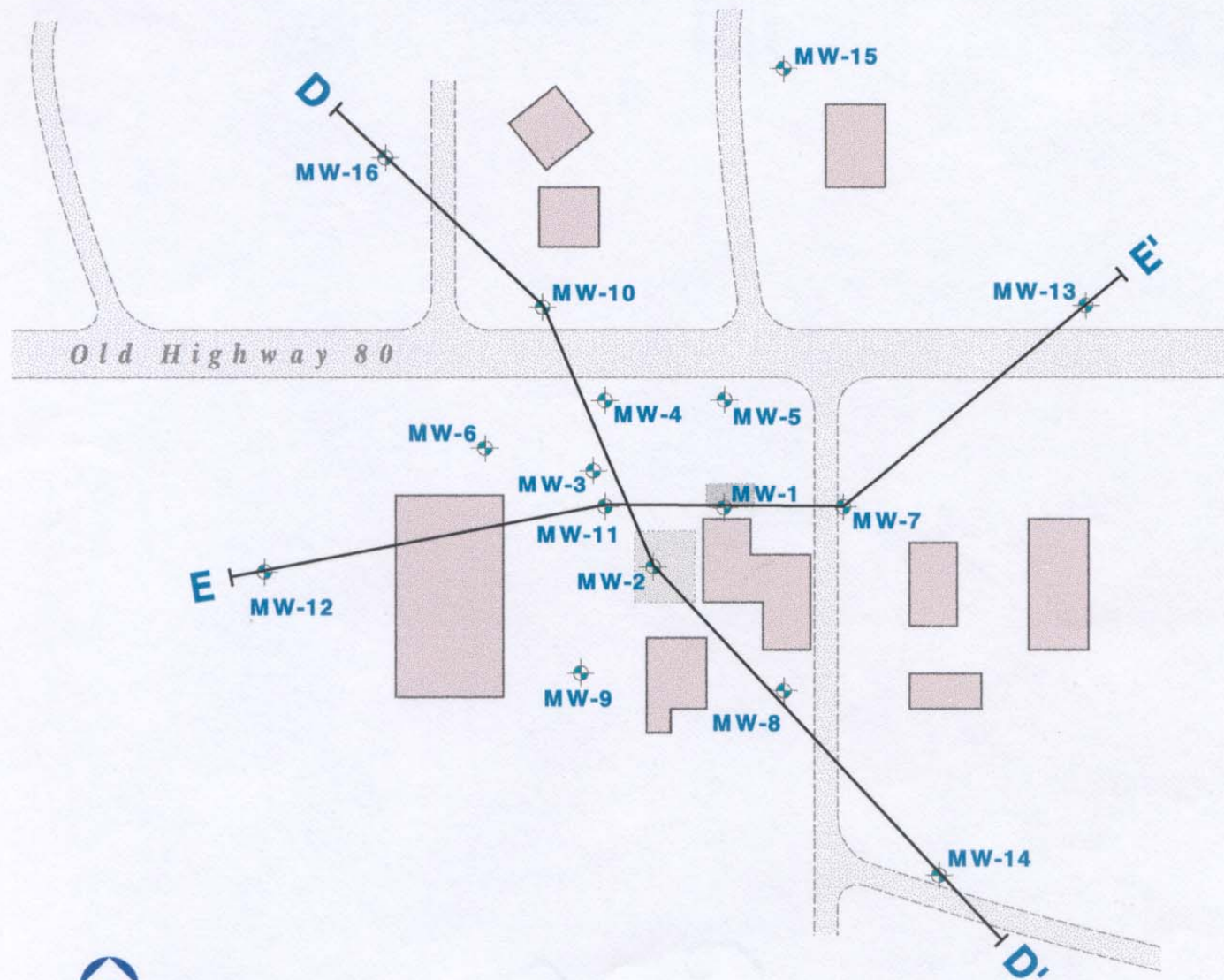








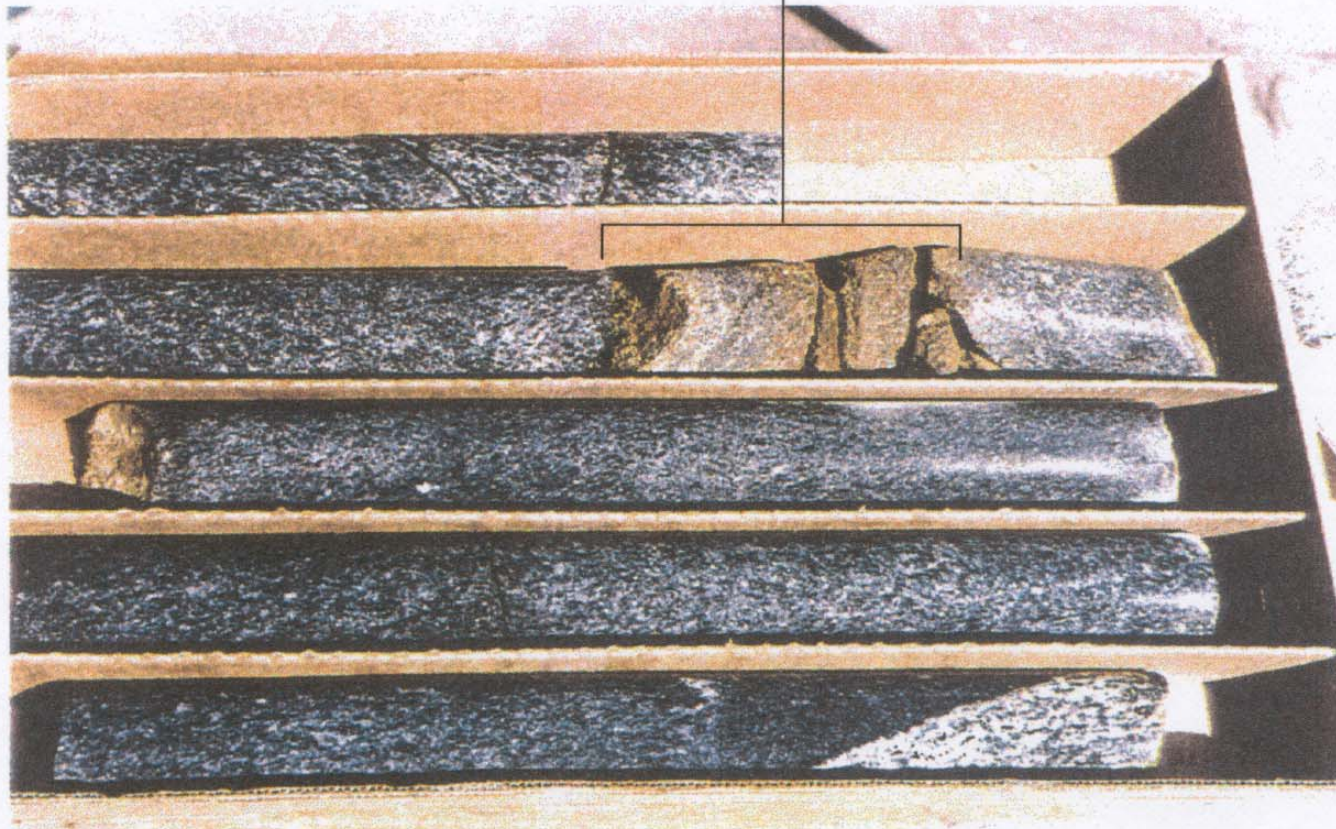






30 Feet  
Below  
Grade

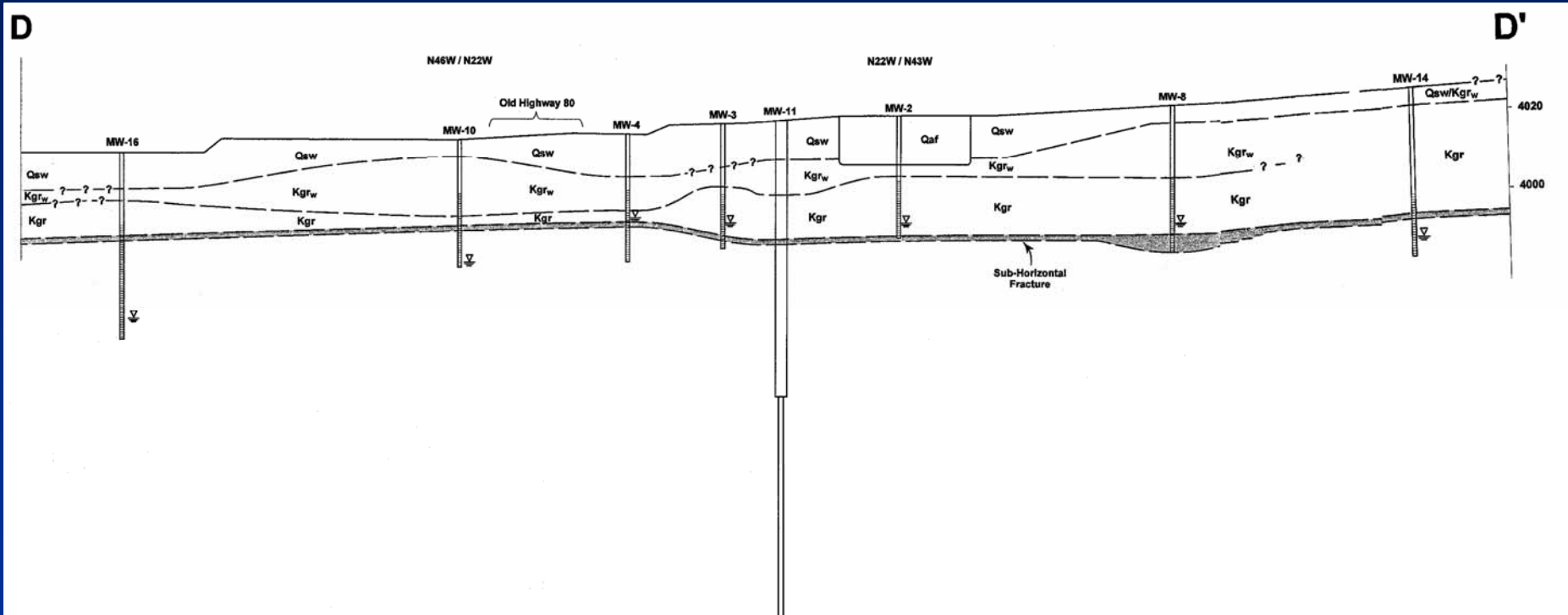
Fracture at Approximately  
32 Feet Below Grade



38 Feet  
Below  
Grade

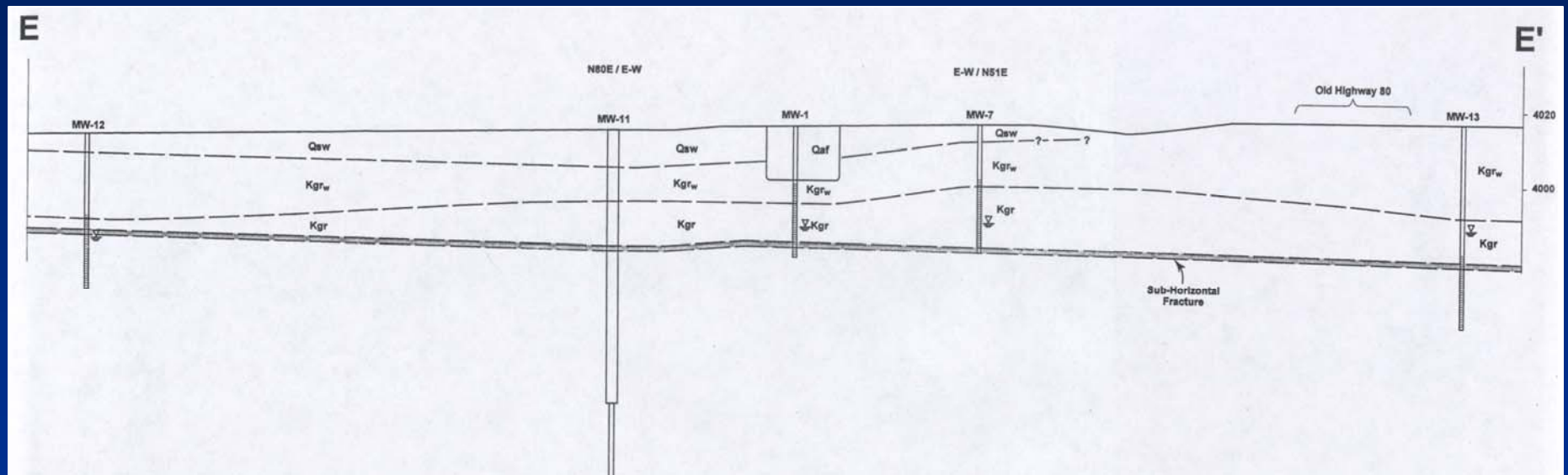
Core Sample at 30-38 Feet Below Grade

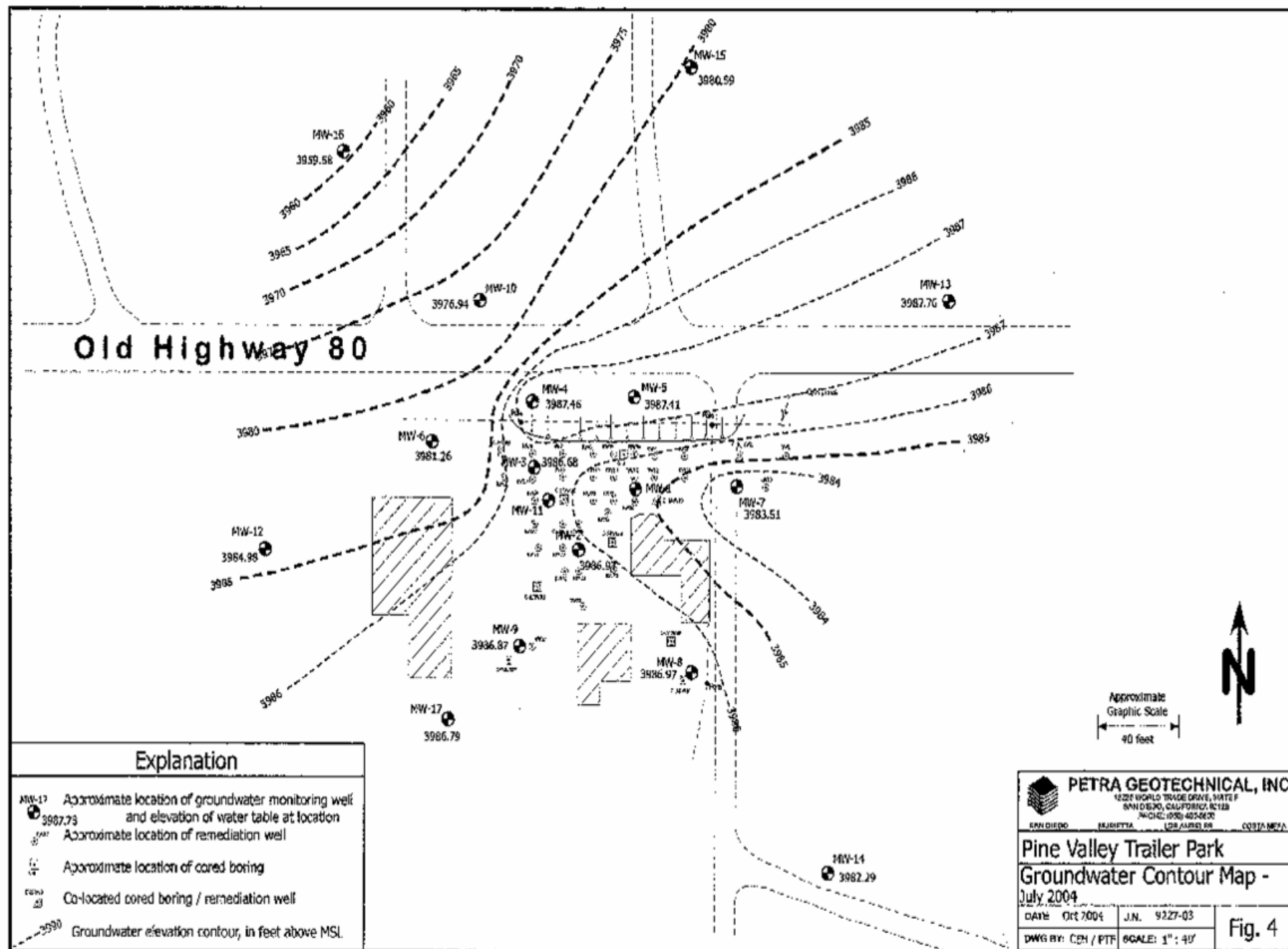
# Cross-Section D-D'





# Cross-Section E-E'





|  |                 |        |
|--|-----------------|--------|
|  <b>PETRA GEOTECHNICAL, INC.</b><br><small>12220 WORLD TRAVEL DRIVE, SUITE F<br/> SAN DIEGO, CALIFORNIA 92128<br/> PHONE: (619) 425-0620<br/> FAX: (619) 425-0620</small> |                 |        |
| <b>Pine Valley Trailer Park</b><br><b>Groundwater Contour Map -</b><br><b>July 2004</b>  |                 |        |
| DATE: Oct 2004   | J.N. 9227-03    | Fig. 4 |
| DWG BY: CEM / PTF  | SCALE: 1" = 40' |        |



# Site History

- Gas station from the 1940's to 1986
- UST's removed in 1992
- Site assessment work began in 1994



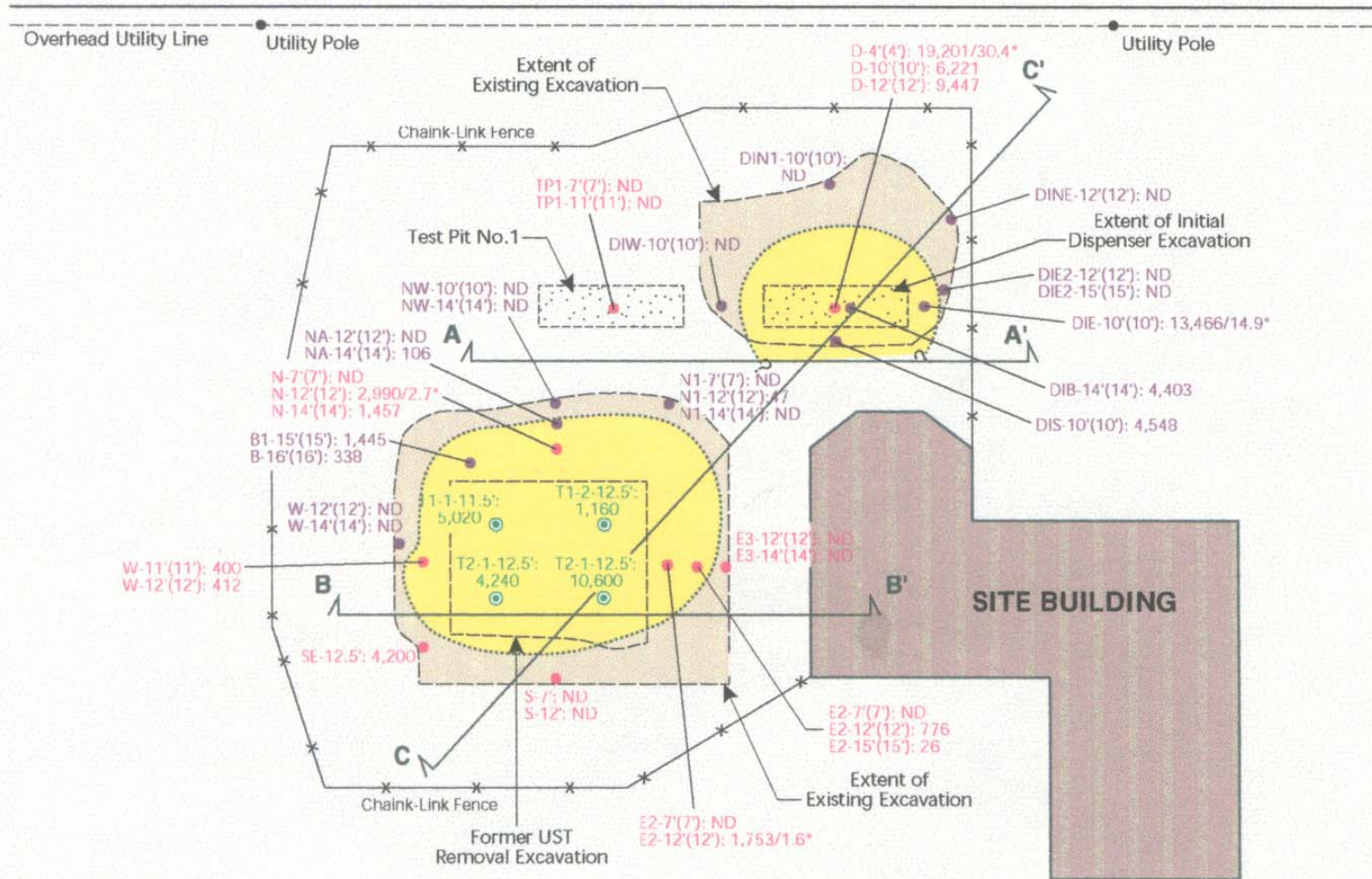


# Delineation of Contamination

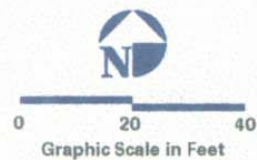
- Soil contamination relatively limited
- 437 tons of contaminated soil and rock removed from site
- Groundwater contamination in fractured rock system



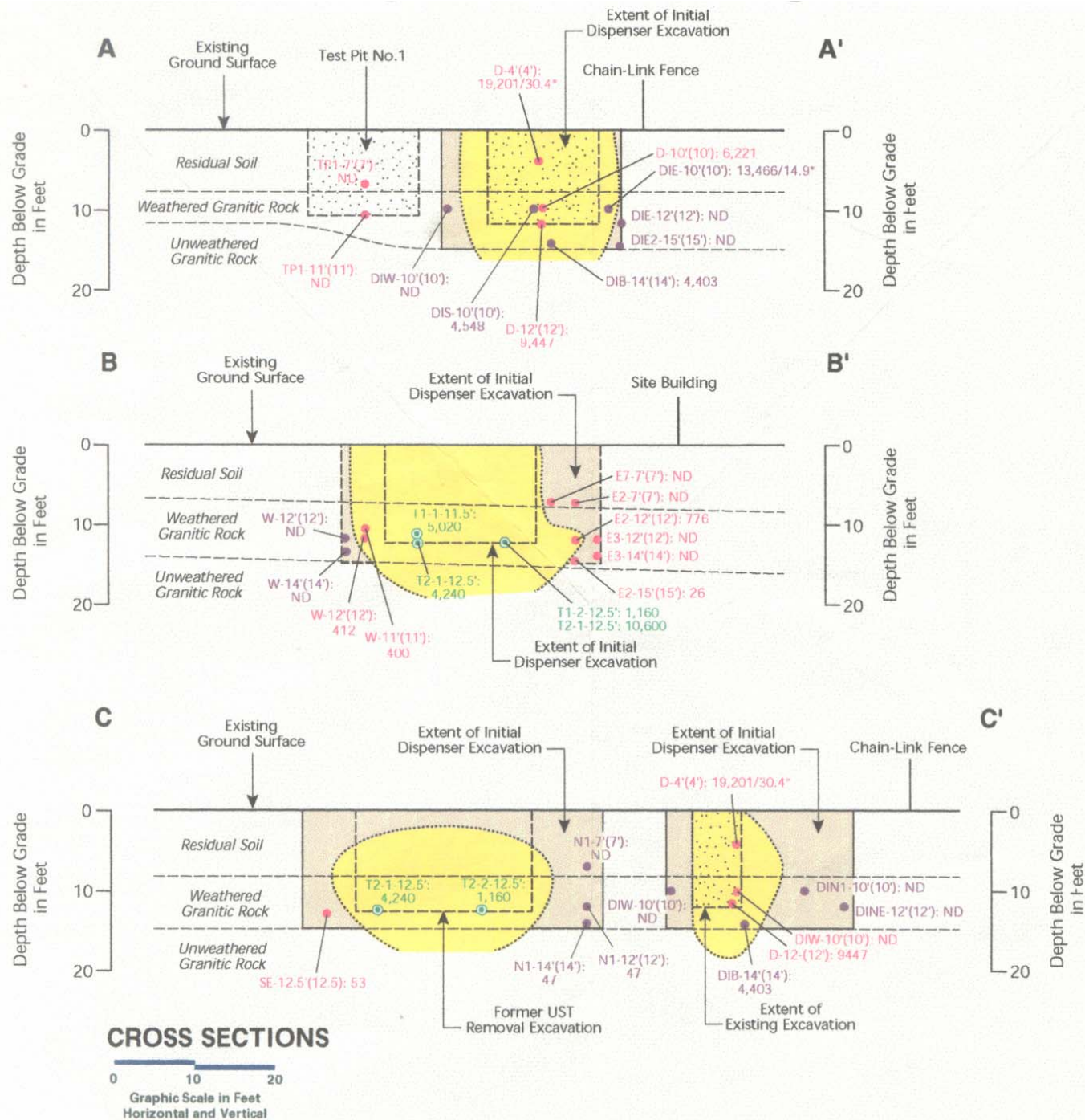
# Old Highway 80

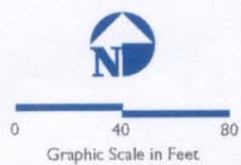
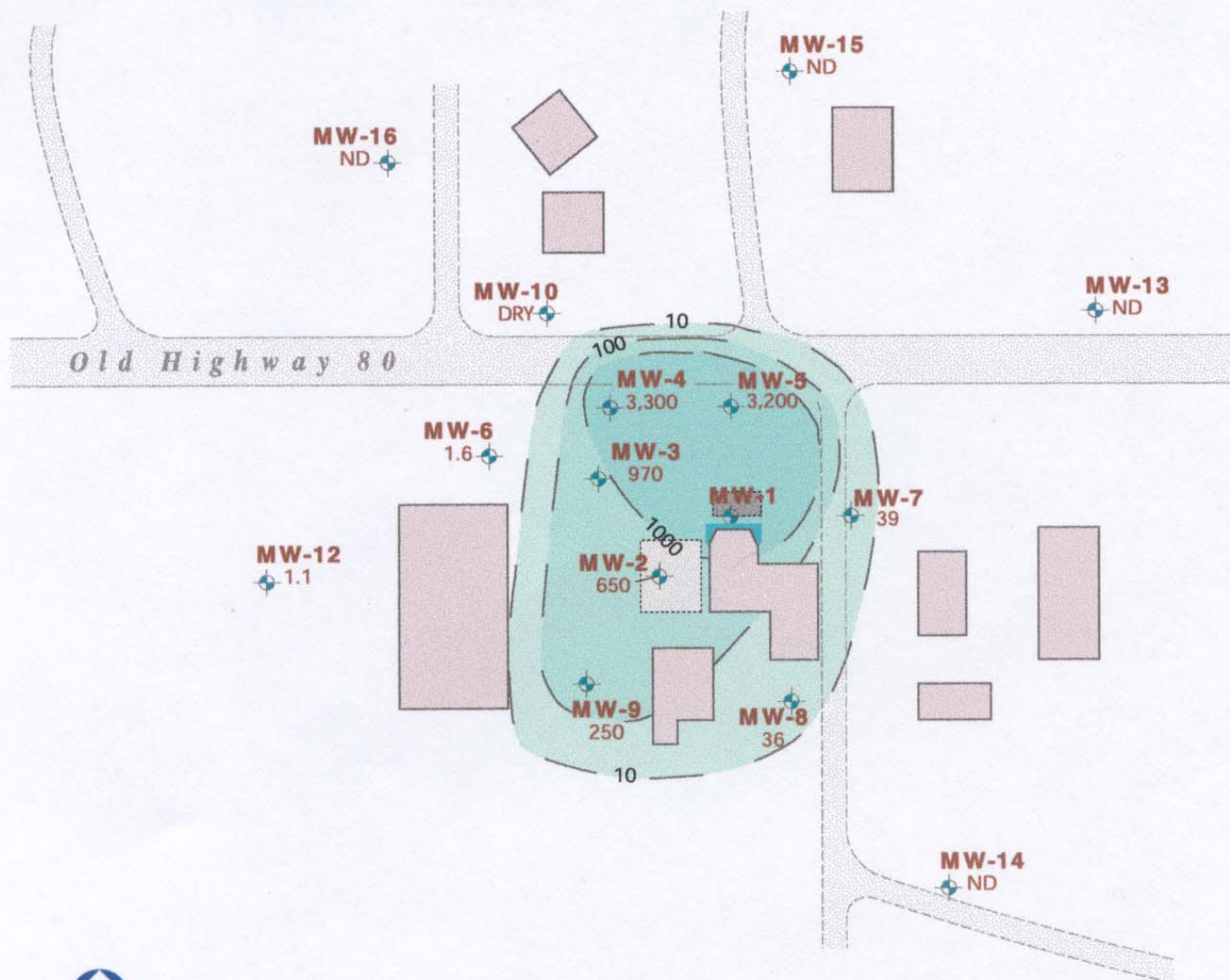


**SITE PLAN**







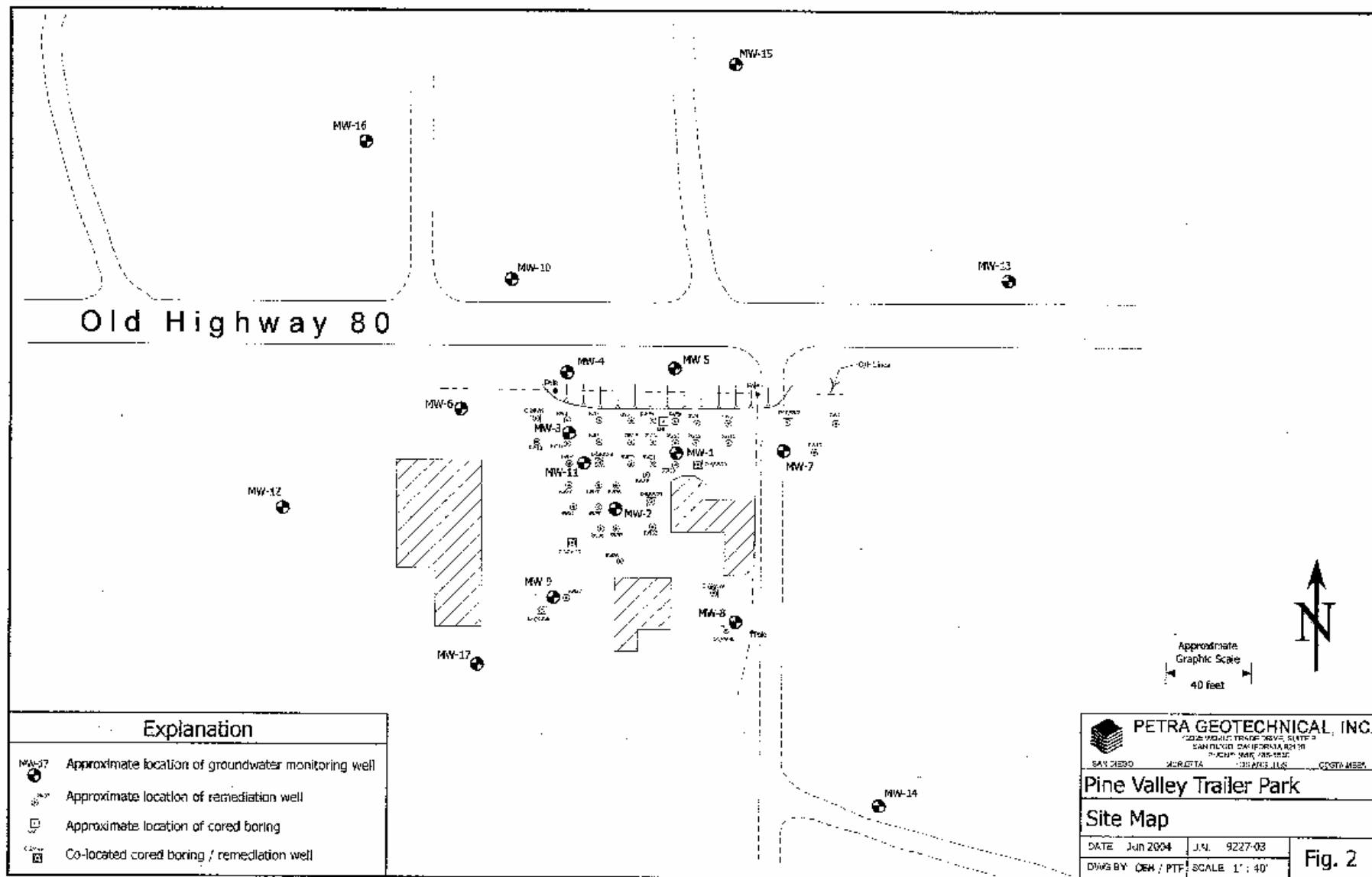




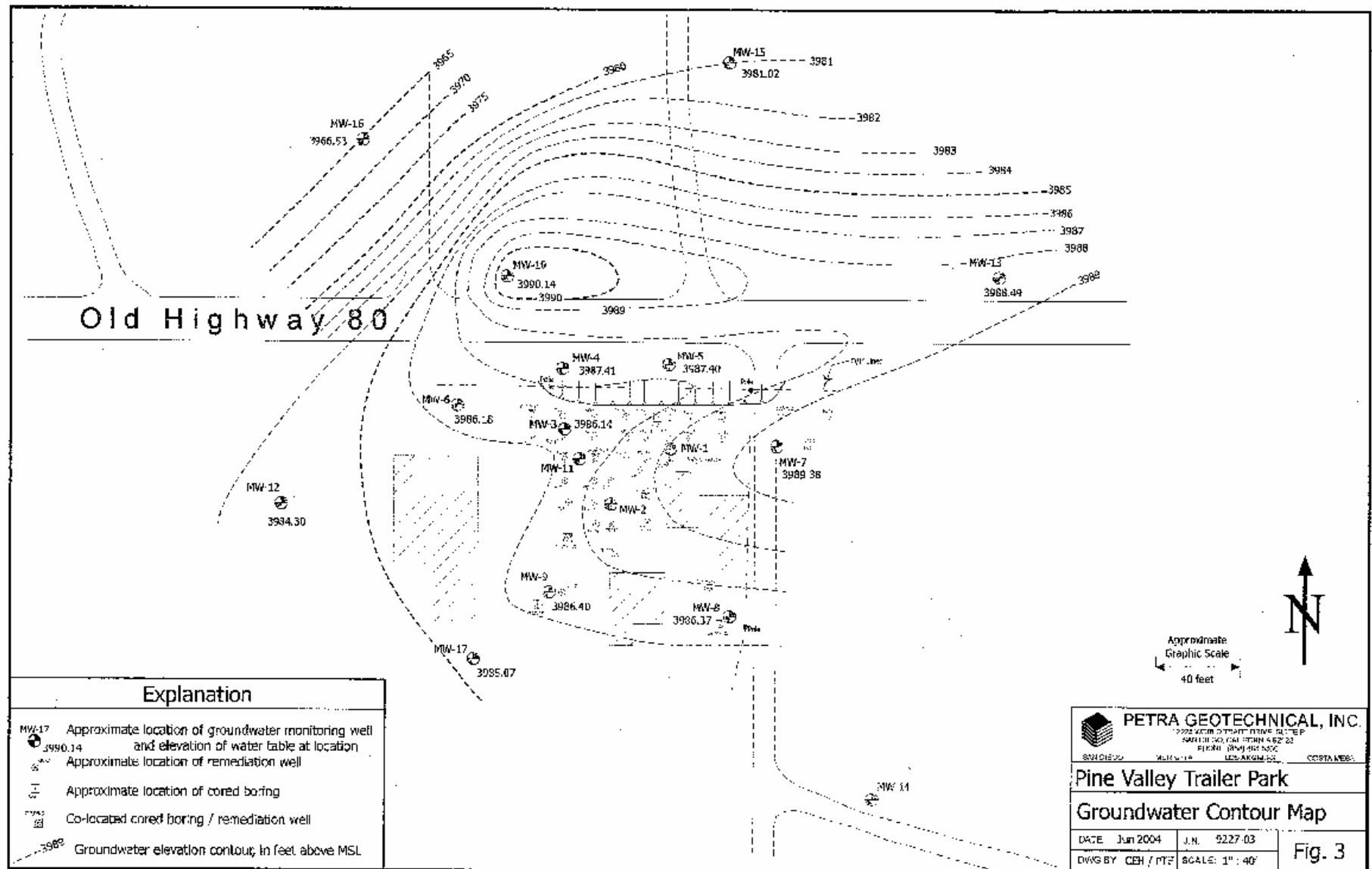
# Groundwater Contamination

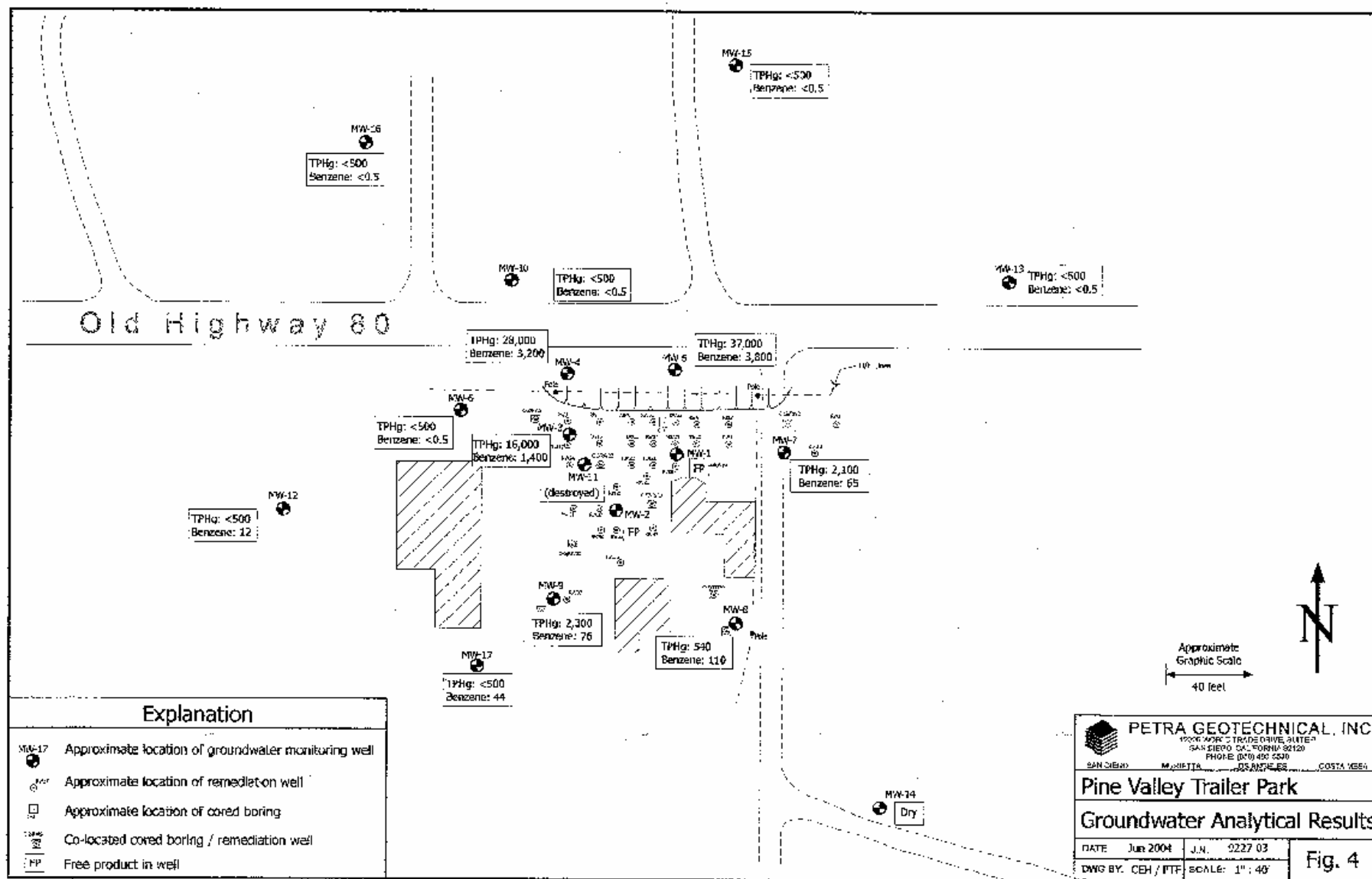
- Plume stable in 2004
- Free product limited to site
- Two distinct water-bearing zones:
  - Shallow - 20 to 40 fbgs
  - Deep – 150 fbgs and below
- Sixteen shallow (<50 fbgs) monitoring wells installed
- One deep well (200 feet) subsequently destroyed to protect resource



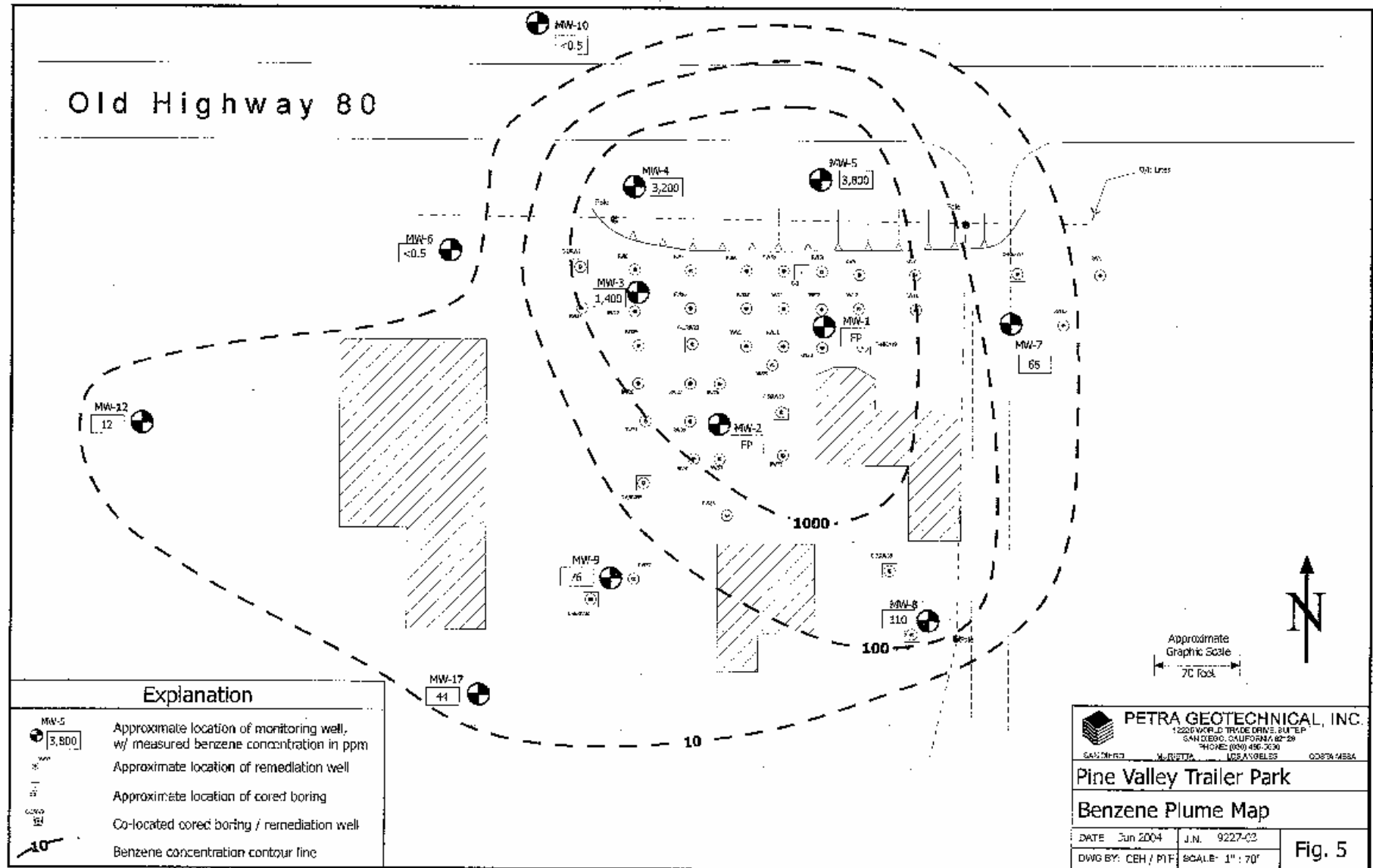




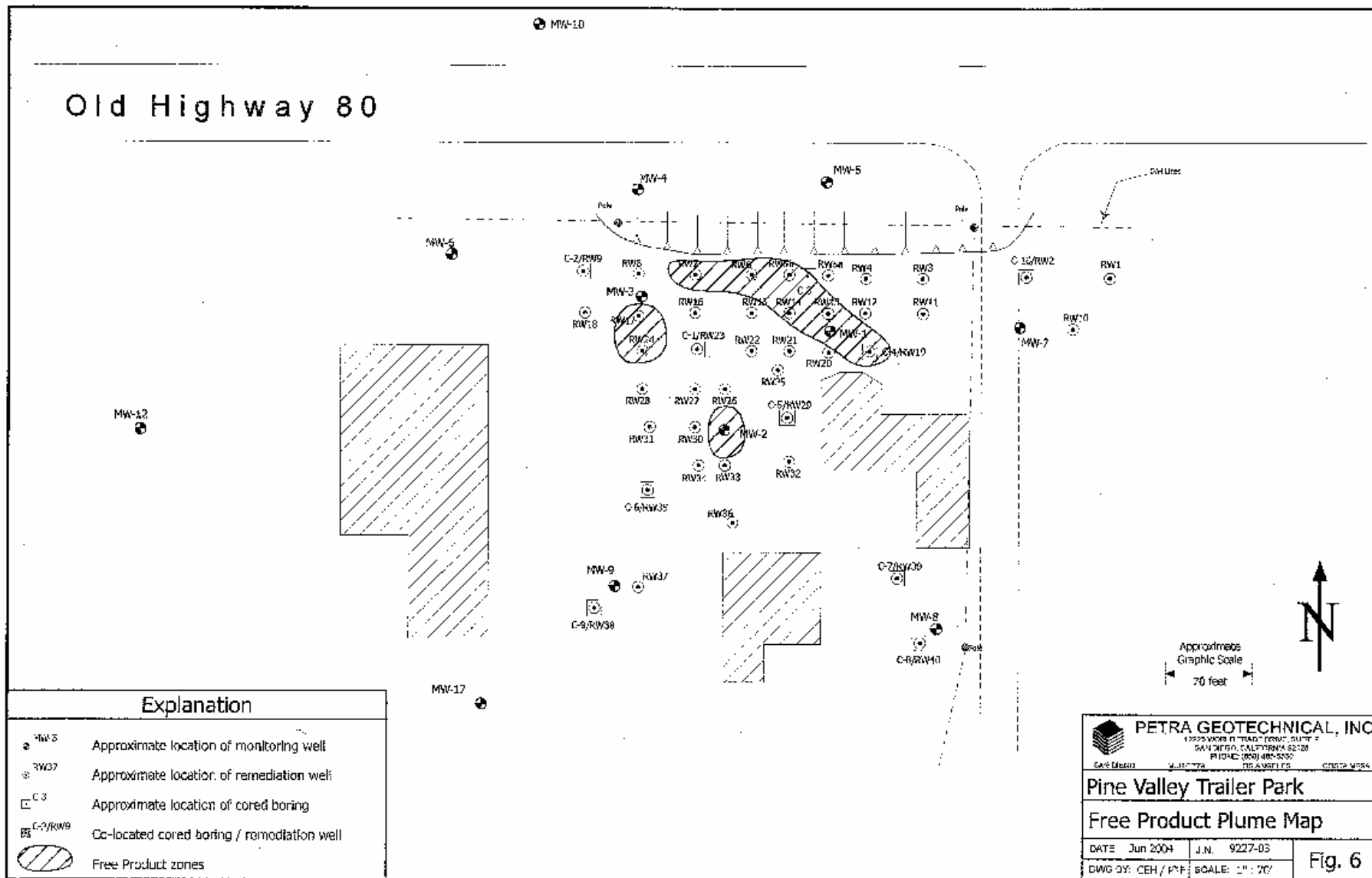








# Old Highway 80



**PETRA GEOTECHNICAL, INC.**  
 1225 WOOD HILL TRAIL, SUITE 2  
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 PHONE: (619) 480-5500  
 FAX: (619) 480-5500  
 WWW: WWW.PETRA-GEOTECHNICAL.COM

**Pine Valley Trailer Park**

**Free Product Plume Map**

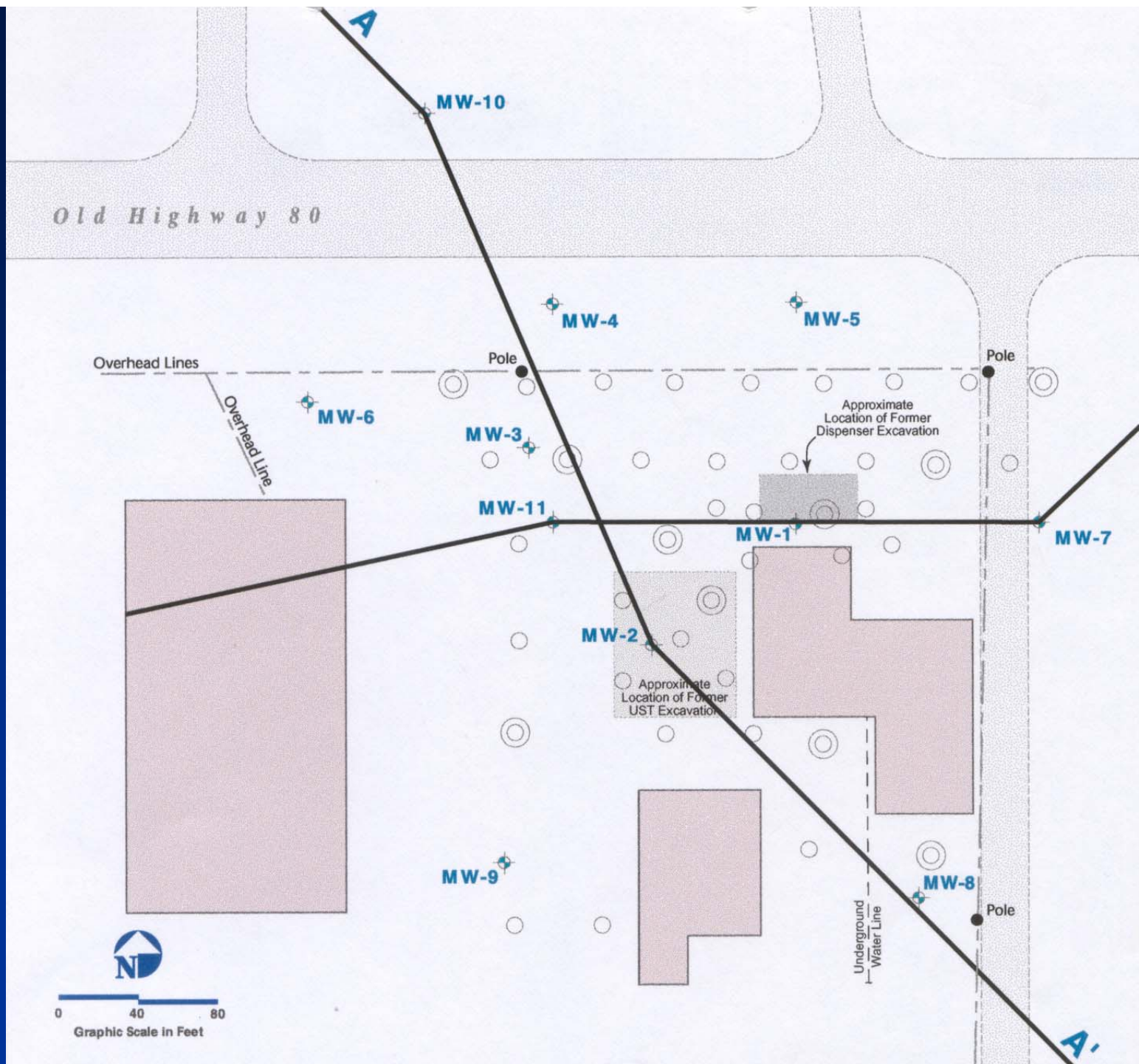
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|-------------------|-----------------|--------|
| DATE: Jun 2004    | J.N. 9227-03    | Fig. 6 |
| DWG BY: CEH / PTF | SCALE: 1" = 70' |        |



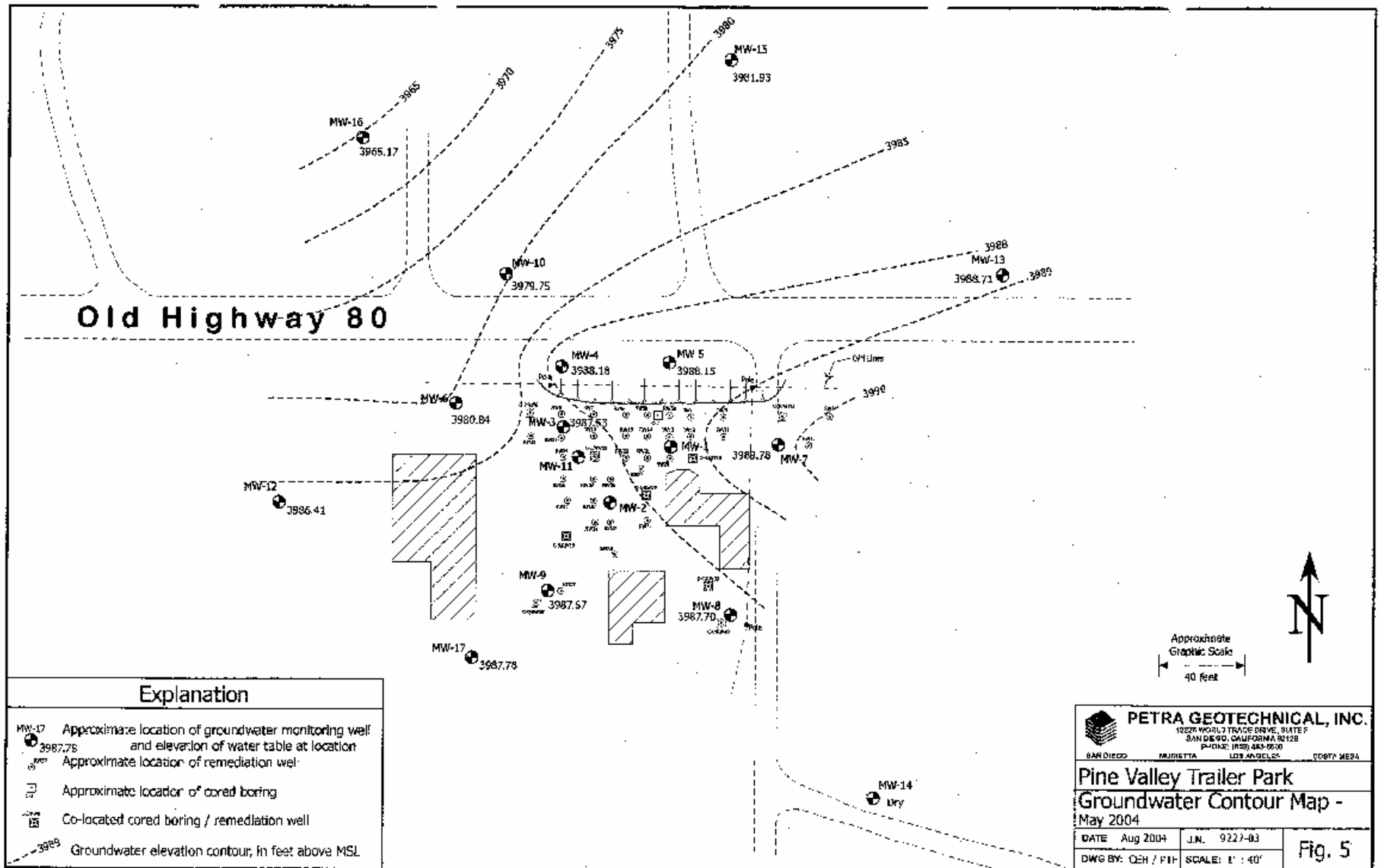
# ORC Application

- Forty-one shallow rock-coring remediation wells installed to delineate fractures and inject ORC in 12/01 to 1/02
- Eight had free product, removed using passive or manual bailing
- Oxygen Releasing Compound then added to wells









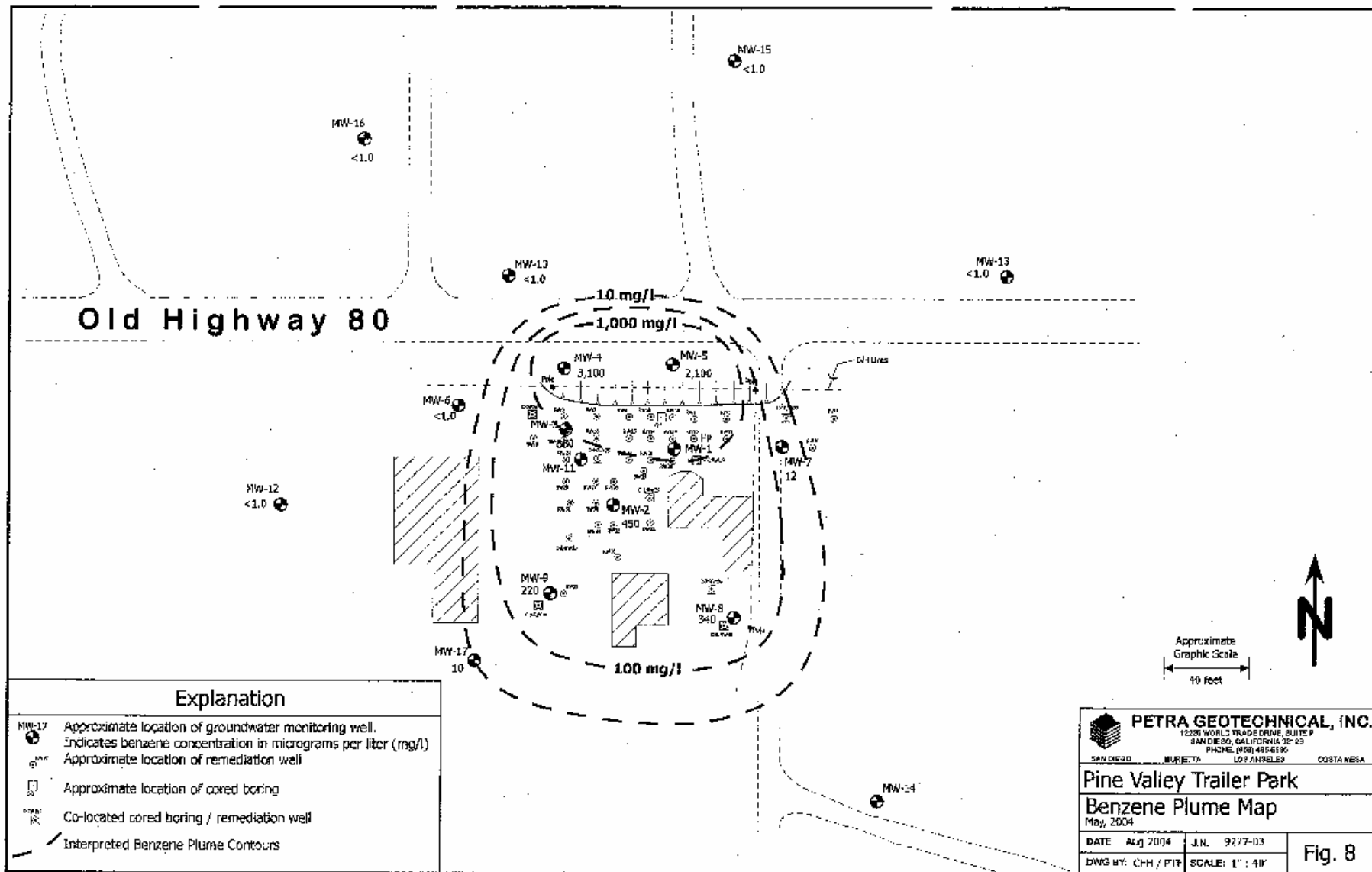
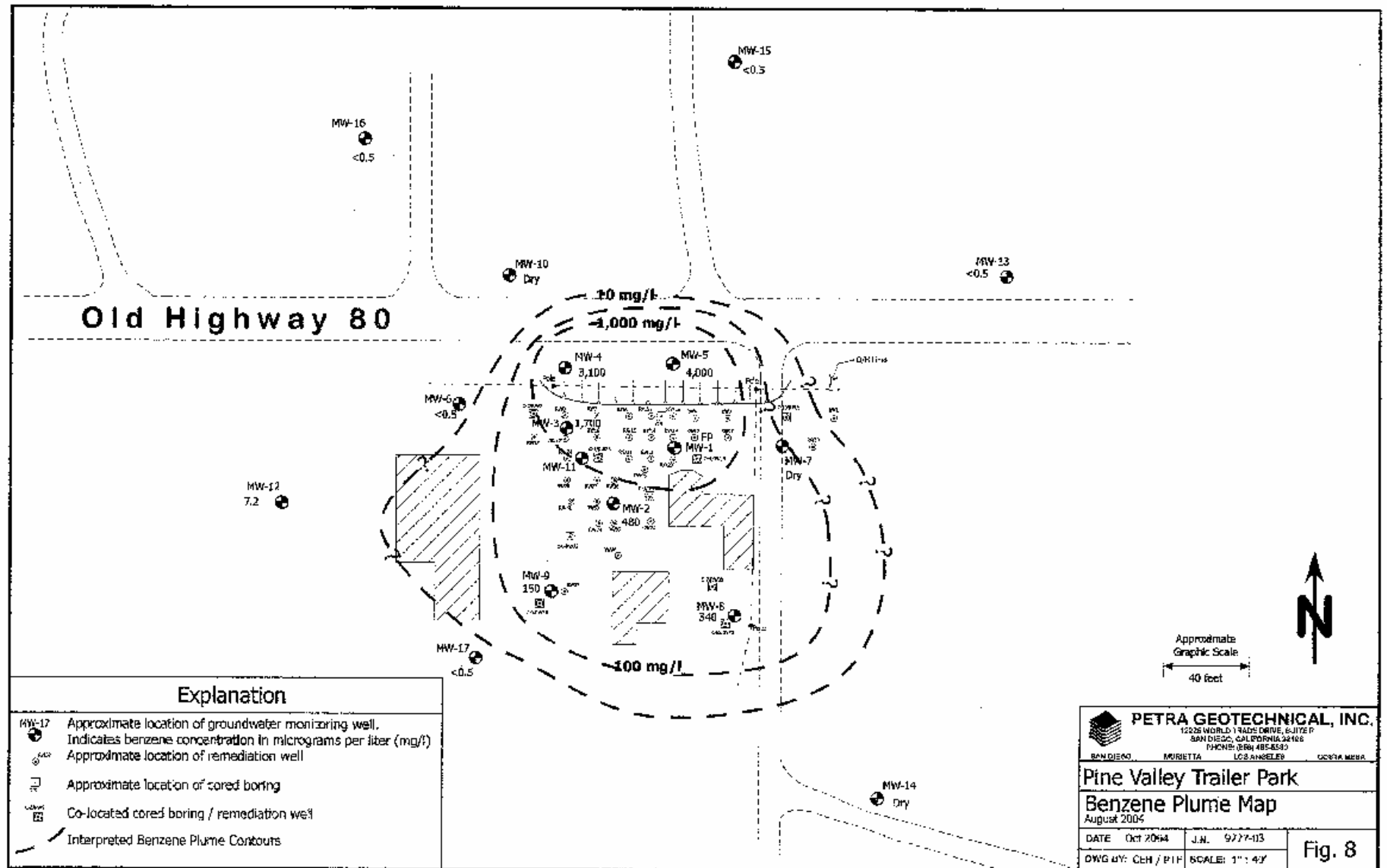
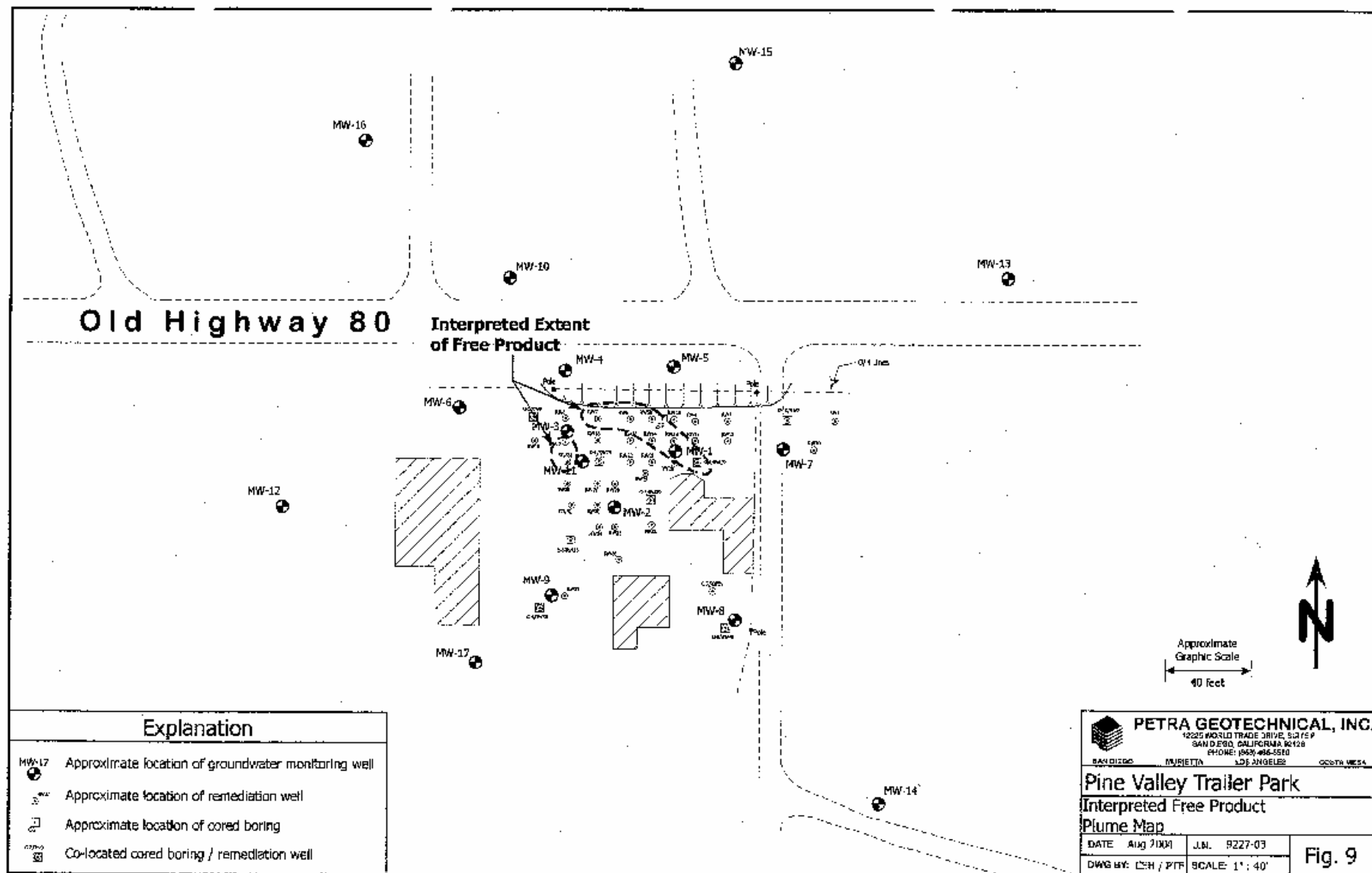


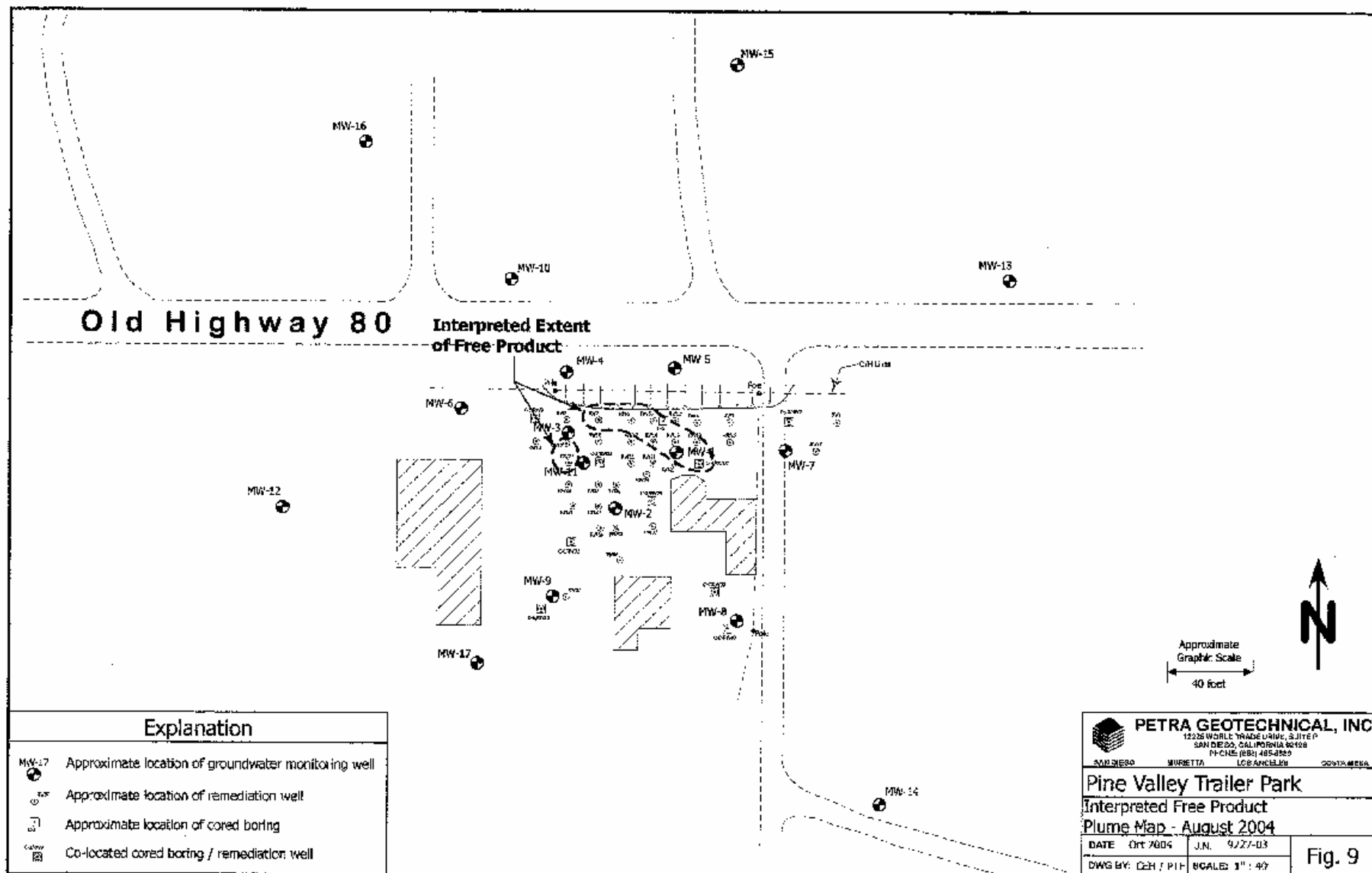
Fig. 8









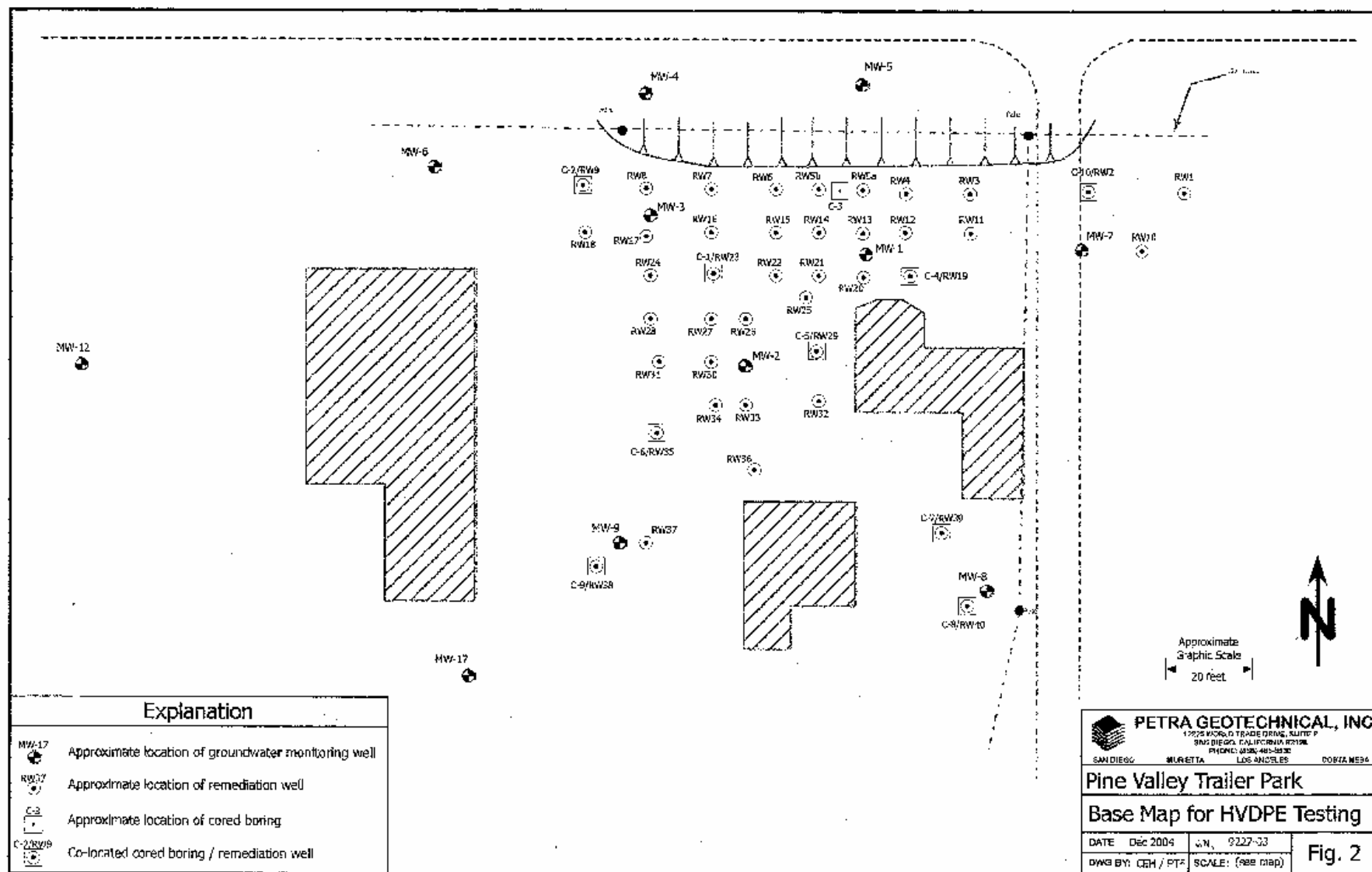


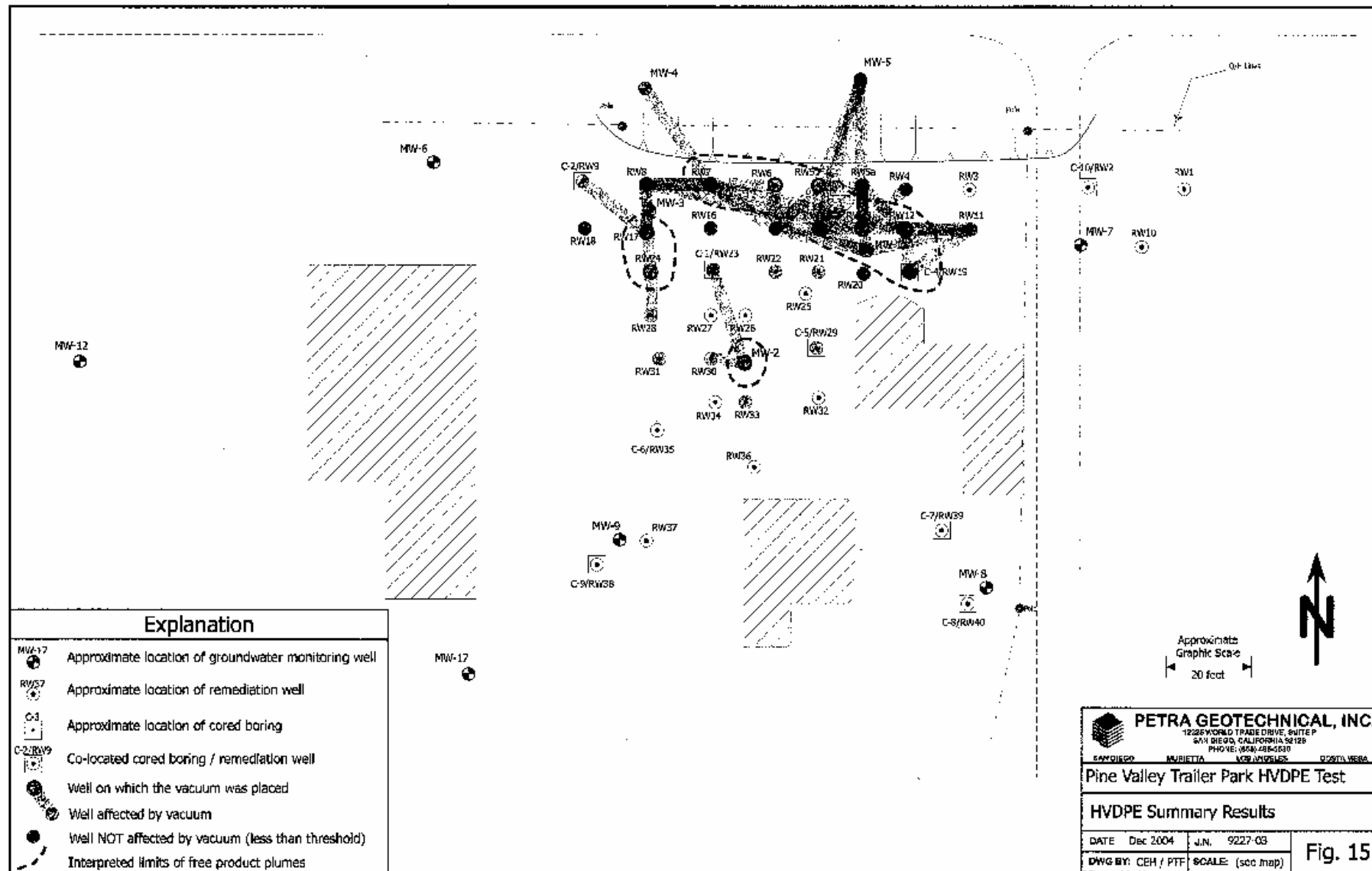
# High Vacuum Dual Phase Extraction

- Preliminary testing indicates method effective at this site
- Seven day pilot test extracted 1.4 tons of hydrocarbons
- Fracture interconnectivity correlates to free product area











# Future Site Remediation

- Four more 30-day HVDPE events have been approved by SAM
- Will evaluate conditions following each event to determine efficacy
- May use ORC again after free product eliminated
- Ultimately hope to go to natural attenuation



# Credits

- Site investigative work cited herein performed by:
  - Barry Pulver, PG, CEG, CHg (with Environmental Business Solutions, then to Southern California Soils and Testing, now with the County of San Diego)
  - and Charles Houser, PG, CEG (formerly with Environmental Business Solutions, then to Southern California Soils and Testing, now with Petra Geotechnical, Inc.)

